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Testimonial Banquet Tendered Charles Nelson Johnson

The Milwaukee Meetings—*Editorial*

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THE JOURNAL
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Original Communications

THE ARTISTIC PHASE OF PROSTHETIC DENTISTRY

By FORREST H. ORTON, D.D.S., St. Paul, Minnesota

(Read before the National Society of Denture Prosthetists, Boston, Massachusetts, August 20, 1920.)

THE frenzied extraction of devitalized teeth in recent years has resulted in an enormously increased demand for artificial teeth. How extensive this increase has been, it is difficult in the absence of available statistics even approximately to estimate. Some of the larger laboratories in different sections of the country report an increase of sales amounting to 80 per cent or 90 per cent. But since there are many denture specialists in the larger centers of population who do not patronize the laboratories, these percentages must be regarded as minimal measures of the increased use of artificial dentures, and we might find a more accurate measure of this use if we had statistics of the sale of artificial teeth at our command.

Hand in hand with this quantitative increase in the demand, there has come also a qualitative modification of standards and requirements. Many of the patients now submitting to the loss of their natural teeth belong to a more fortunate circumstanced economic class than was formerly the case. People of means, and those who have been trained to appreciate the importance of efficient mastication, are now creating a demand for the most adequate substitutes that it is possible for science and art to devise, and as a corollary of this fact, a rate of

compensation is now being received for this work which was undreamed of a few years ago. In short, the new conditions here referred to constitute both a demand and a stimulus for a more efficient technic than has been generally prevalent in the profession.

The fact that we are becoming anxious to meet these more exacting requirements is evidenced among other things by the constantly increasing number of study clubs formed thruout the country to supplement the training received in college years. Not that the teaching of this subject in our colleges can be justly stamped as always inadequate—I know several colleges that are offering very excellent courses in prosthesis. It is more than probable, however, that the average student rushes thru this work somewhat perfunctorily in college, as a task that he longs to put behind him, justifying himself with the thought that once safe in practice the laboratory is at hand with its ready and convenient service. Only when it is too late, perhaps, does he discover that neither his own skill nor the product of the laboratory is able to meet his own and the patient's expectation.

It is, in these circumstances, natural and relatively easy to place the whole burden of blame exclusively upon the laboratory. The laboratories are naturally dependent upon the patronage of their critics. They do not feel that they can afford to defend themselves too vigorously or too publicly, if, as often happens, the burden of their defense would be an arraignment of the competence and an exposure of the weaknesses of their clients. They choose to accept for the most part the position of scapegoats. Other critics carry the war still farther and challenge the very existense of the laboratory as being naturally destructive of a high and capable workmanship on the part of the profession.

It may therefore be well for us to consider thoughtfully not only the role of the laboratory, but also the standards of workmanship set by the profession generally, to see if we cannot find some practicable and effective road toward that improvement which the public demands, and the ardor of our professional pride points out as desirable. The fact is we are confronted with a problem which every useful and necessary art must sooner or later attempt to solve. There are arts so indispensable that we will always continue to practice them, however low the level of our average success, or even tho the pressure of our need compels us to practice them poorly if we cannot practice them well. Dentistry is such an art. In every such art we are faced with the necessity of efficiently meeting the needs of the patron at a price that he can afford to pay, and thus maintain the quality of our work while at the same time reducing its cost. The industrial arts have faced this problem and have sought to solve it, speaking generally, by reliance on some plan of quantity production. And it will help, if we remember that in dentistry it is the laboratory which represents this industrial idea of quantity production.

It cannot be denied that the laboratory tends to introduce into dentistry undesirable influences. Many prominent prosthetists regard it as chiefly responsible for the general apathy toward the art of prosthetic dentistry, which previals among dentists. And they maintain that it is quite useless to expect any improvement, any considerable development of interest in the art of denture making at the hands of dentists who simply delegate this work to others. When we buy something from the laboratory and sell it to the patient at a profit, we seem to be duplicating a situation within the realm of dentistry, which has elsewhere made strongly for the deterioration of the arts and crafts. As machine production superseded craftsmanship, and the basis for fixing the price of the article shifted from workmanship to

salesman, there went in many fields a constantly increasing elimination of the skilled personality of the worker and its merging in the machine, which meets the requirements of mass production.

The creative impulse is innate to man and is a heritage whose preservation is indispensable to the development of every art. Its satisfaction is the source of our deepest joys and it is the stimulus of our most effective thought. Man began to think when he began to use his hands. The introduction of various forms of craftsmanship into the curriculum of our public schools can be justified on the score of their general cultural values alone, and not merely because of the capacity afforded by them to make some specific article. Anything which would tend to paralyze or weaken this impulse among members of our profession would indeed be a calamity irretrievable and devastating. Many entertain the fear that the growing tendency among dentists everywhere to rely upon the laboratory will eventually result in extinguishing the instinct of creative effort and in quenching the ardor of skilled workmanship. The laboratories, these vast industrial enterprises of such immense development in recent years, are for the most part financed by the dental depots and the manufacturers. It is feared that the standard of workmanship in these laboratories, instead of being maintained and constantly improved by skilled craftsmen, must necessarily decline more and more under the influence of business enterprises and the profit motive. It is feared that they may thus come to exert a corrupting influence on the standards of craftsmanship in dentistry generally, perhaps even revolutionizing the intellectual and moral concepts of the dentist in relation to his work. This is an influence that threatens not only prosthetic dentistry, but the specialty of crown and bridge-work as well.

The laboratories, on the other hand, are not without their defense. Their answer is twofold. If the foregoing arraignment has its measure of truth, it is nevertheless one-sided and neglects many important aspects of the situation. They go on to say that the laboratory is first an economic necessity, and secondly not wholly responsible for its faults of workmanship, which they claim are remediable without destroying the laboratory.

With respect to the first point, I am inclined to agree that the dental laboratory has come to stay. Times have changed and it is now impossible for us to go back to the days when every dentist did his own laboratory work. The laboratory has become a fixed institution, an indispensable part of our environment and we cannot ordinarily discard this or that feature of our environment, except as we make it over or replace it with something of greater positive service. The dental laboratory may be improved or reformed, but I scarcely expect to see it abolished.

As for the second point, I am inclined to feel that a study of the underlying causes for the faults justly found with laboratory work should be of considerable advantage to us. A frank and constructive criticism of the profession on the part of the laboratories, and from their point of view, might not prove to be unproductive of useful results. Leading laboratory men have shown a willingness to discuss with me, confidentially, the causes of imperfect work, and the incidence of responsibility for failure. They point, in this connection, to a widespread lack of fundamental knowledge on the part of the profession at large—on the part of those who constitute their clients. They have furnished me with lists, itemizing frequent deficiencies of skill or knowledge on the part of practitioners, that constitute serious obstacles to satisfactory results, and these lists, coming

from many different sections of the United States, show a degree of resemblance and unanimity that would indicate that these deficiencies are general and widespread, indicating the common run of cases received by the laboratories, rather than extreme or exceptional instances. I append a summary of one of these lists:

A. Dentures

1. Poor impressions, owing to the use of too much material, and to poorly fitting trays.
2. Impressions too short in the vault, making it impossible to take advantage of extending plate line for proper retention.
3. Poor bites. Much or biscuit bites taken with no consideration of proper distance between upper and lower ridges, generally too close, thus necessitating opening of bites on the articulator.
4. Lack of correction of the plans of occlusion in cases where only one denture is being used and the natural teeth are occluding. Lack of diagnosis of the mouth for correction of hard bulbous tuberosity and hard prominent process.
5. Ignorance of the proper selection of impression material to correspond with the condition of the mouth tissues.
6. In the case of compound impressions, a lack of knowledge of compound technic resulting in impression dragging, and absence of details in the impression.
7. Improper mixture of plaster, or deterioration of plaster thru exposure, resulting in a plaster cast that is too soft.
8. Incorrect bites indicating protrusiveness or state of muscle strain.
9. In general, preparations for laboratory work show an inclination on the part of the dentist to save time for himself, at the same time requesting the laboratory to rush the work back.

B. Bridgework

1. Impressions and bites taken for only one side, the side where the restoration is to be made.
2. Crowns and bridges ordered made without any preparation on the abutments.
3. Bites crushed and distorted in removal from mouth.
4. Gold crowns received without contact point.
5. Compound impressions with crown abutments for bridges, showing dragging around crowns and looseness of impression.

Such a list gives some support to the claim of the laboratories that the quality of their work is but an index of the knowledge and ideals possessed by the dentists who patronize them. It is of course true that every community harbors a few dentists who insist on a higher standard of work than the local laboratory is equipped to furnish. Yet in general the laboratory satisfies fairly well the larger and average demand, which is of course the indispensable condition of their prosperity. Where there is a large and consistent demand for work of a better quality, the laboratory will supply it. And some laboratories have actually financed study clubs in order to educate the local members of the profession, and thus create a demand for a better quality of work whereby they have made themselves a positive force toward securing improved standards of workmanship.

The criticisms listed above have been quoted because they seem sufficiently objective to have a constructive value. I have made no attempt to register all the emotional reactions met with in making my inquiries. One laboratory man told me that the average dentist seemed to him to have so little knowledge of the subject that it was hopeless to expect from him any capacity to judge adequately or fairly the real cause of a failure in denture making. He would be unable to say whether it was the fault of the laboratory or of the impression furnished the laboratory, of the measurements taken as a guide to the articulation, or of the consistence of the plaster mixture, or the use of an improper fitting tray. A large proportion of the profession, he claimed, is only half-educated in prosthesis, possessed only of an amateurish sort of semi-

knowledge. And this in the face of an enormously increased demand for dentures by a public that is being educated to appreciate the importance of efficient mastication!

Thus when we inquire into the causes of imperfect denture making we discover the dentist passing the buck to the laboratory, as the current phrase goes, and the laboratory in turn passing the buck again to the training of the dentist, that is by implication, at least, to the colleges. If the colleges could be put on their defense, I suppose that they too would indulge in the same popular pastime. They might point to the character of the material they have to work with and to the limited time at their disposal. The boy that enters a dental school is influenced by the desire to make a living. The bread-and-butter problem often looms so large on his horizon that it prevents his obtaining a view of his education as primarily a preparation for life and only secondarily a preparation for earning a livelihood. This point of view goes far to explain why so many enter professions for which they have never been properly fitted, for which they have no native talent, and for which in consequence they never come to display any ideal enthusiasm. Because he is forced to assume a task for which he has no taste, the circumscribed mechanical phase of the work becomes an irksome drudgery. His one concern is for the necessary credits. As one student told me, the majority console themselves with the comforting reflection that when the tasks set in college are somehow left behind, it will not be necessary for them to bother about doing such work anyway, since they will then be able to follow the practice of most dentists of their acquaintance, and "turn it all over to the dental laboratories."

An illuminating remark! But what is the reason for this lack of interest, everywhere complained of, and sometimes ascribed to the existence of the laboratories as a sole or exclusive cause? Perhaps it would profit us to turn our attention in another direction for a moment. For a quarter of a century the dental profession has been devoting its attention almost wholly to the mechanical and scientific aspects of its work, to the relative neglect of the aesthetic and artistic side. Have we not here perhaps a neglected motive power that might be made to further good workmanship? There is an accepted technic for the mechanical side of dentistry which serves as a guide to students, but the neglect of the artistic phases of our art shows that there exists no corresponding code of procedure for the solution of our aesthetic problems. And yet it is the presence of the aesthetic element which makes dentistry not only a useful art but also a fine art. And minds which cannot be stirred by purely scientific considerations to a deep and personal interest might have their instincts of workmanship awakened if brought in contact with a proper aspect of the aesthetic problem.

The replacing of natural teeth by artificial dentures can certainly be accounted a fine art, if we are determined to make a serious effort to satisfy the aesthetic demands involved. And it is only by redeeming its status as such a fine art that we can hope to assure to its practice the aspirations and motives and satisfactions and standards of creative workmanship. Whether the laboratory establishes itself permanently or not, it remains our problem to reveal and to disseminate those artistic standards which can alone secure for the practice of dentistry the joys and motives and stimulations of the artist.

Can the colleges do anything to awaken and strengthen these artistic impulses? There are some who assume that success in obtaining artistic results must always remain a mere matter of what is called "taste," a something

based wholly on individual endowment, and consequently not teachable. It is something, they say, which cannot be reduced to principle or formulated in conscious standards. It can only be cultivated thru the more or less unconscious absorption of feeling as the residuum of observation and experience. If this opinion were true it would be quite impossible to explain rationally the progress of the arts. If all artistic knowledge possessed by one man or generation were to be absolutely incapable of communication to another or to the next generation, the latter would always be compelled to begin with the beginning and no important progress could ever have been effected. It is impossible to deny that artistic standards and principles are both discoverable and communicable, just as scientific standards and principles are discoverable and communicable. And if the student could be given a vision of the artistic possibilities of dentistry while yet in college, together with some simple guidance in the form of recognized standards and principles pertaining thereto, would not much have been done to give him a greater joy and zest in his work, to afford him a motive for spontaneously setting his standards of workmanship high, and thus, in spite of the laboratory, or irrespective of the laboratory, arrest the threatened deterioration of his skill?

Let me then ask you to consider with me some of the more obvious aesthetic possibilities of prosthetic dentistry, possibilities which have been more or less unexploited and undeveloped. Some of these are to be found in the field of dental anatomy, while others concern mainly the aesthetic requirements involved in matching artificial and natural teeth with respect to color.

It is true that dental anatomy is taught more or less thoroly in the colleges. But the understanding thus acquired is mainly from the standpoint of dental surgery—it is the kind of knowledge necessary for us to have when we operate on the natural teeth. But it is necessary to understand anatomy also from the artist's standpoint, from the standpoint of the modeler or the sculptor. Anyone who has noted the conventionalized forms that the average student gives to his wax models in attempting to carve a crown must conclude that while he may have a book knowledge of the subject sufficient to enable him to give a fairly good description, he has no such intimate acquaintance as would result from training in the power to visualize the teeth, or as would enable him to reproduce it in the spirit of an artist or sculptor. We see for the most part only what we are trained to see. Some such thought must have been in the mind of Dr. J. Leon Williams when he wrote his notable paper on the "Aesthetic and Anatomical Basis for Dental Prosthesis" in 1910. While giving us a scientific classification to replace the hazy and empirical methods which had previously sufficed us, he treated his subject principally from the standpoint of an artist. He called our attention to the fundamental design which forms the basis for the shapes of teeth. He then proceeded to analyze this into its elements.

The technic of an artist does not after all differ fundamentally or in principle from the method of analysis and synthesis practiced by the chemist or other scientist. The fact that Dr. Williams' presentation is undeniably from the artistic point of view explains why it has been so widely read and understood. A purely mechanical presentation would not have appealed to so many different types of mind. There are, of course, abstract minds, practical minds, inquisitive and acquisitive minds, minds adapted to language, and minds adapted to mechanics. Perhaps we sometimes make the mistake of adapting our courses of study to only one type of mind, and

thus find that many of our pupils cannot be reached by our instruction.

Had Dr. Williams extended his researches to include the analysis of those acquired characteristics which are typical of the teeth of middle age and after, he would have placed the dental profession under still greater obligations. I do not mean that all possible defects or acquired peculiarities can be classified and described in advance, but there are many which can safely be regarded as typical, since they constantly recur as the result of age and wear. Such are the exposed and stained line of dentin on the incisal surface of the lower incisors; the recession and consequent exposed labial root over the upper cuspids; the check invariably found running from the incisal to the gingival of the labial enamel plate of the upper incisors. By far the largest percentage of those for whom we make dentures are past middle life and yet the teeth furnished us by the manufacturers to place in their mouths are the teeth of youth, showing none of the evidences of age or wear or pathology. It is impossible to avoid experiencing a feeling of decided incongruity when we are forced to place these youthful specimens in the mouths of elderly patients.

I am familiar with the artistic possibilities that may nevertheless be obtained by the processes of grinding and staining. But the dentist may reasonably object that these processes require expensive equipment, and an amount of time out of proportion to the remuneration that may reasonably be expected from the patient, especially as he is probably not in a position to judge the artistic value of such work. The manufacturer, on the other hand, could easily imitate these peculiarities at a very small cost, and even tho it might be necessary to resort to hand staining, the manufacturer could do the work cheaper than the dentist. One need not be unfair to the manufacturer, or expect him to be actuated solely by philanthropic motives, but if manufacturers are sincere in their claim that they stand ready "to co-operate with the profession in all endeavors to realize their ideals," then it is only fair to ask why they have failed to meet the demand for a better imitation of the natural teeth—not only with respect to the peculiarities described above, but also with respect to color and its proper distribution. When we select teeth for a full upper and lower denture, color defects are naturally not so noticeable as they are when we attempt to match the natural teeth remaining in the mouth. In the former case we depend entirely on a certain vague and relatively uncontrolled judgment. To make this judgment accurate we require an intimate knowledge of the color tints and shades which are reflected by the natural teeth, supplemented at least by an elementary understanding of the science of chromatics. Lacking such knowledge there is nothing to do but to fall back upon the uncertain guide known as taste. How far this empirical method has met with success may be gauged by the prevalence of the popular joke about the ghastliness of "false" teeth, where the word "false" is advisedly emphasized. But when we attempt to match a natural tooth by one that is artificial, we have the natural tooth as a basis for comparison and as a standard of control. Who of us has not felt the hopelessness of trying to match the characteristic shape and coloring of the natural tooth with the bits of porcelain to be found at the depots? Have we not all hoped that some American manufacturer would at least be found to satisfy our legitimate demands for naturalness in artificial teeth, so that the depots would be willing to carry an adequate supply for matching purposes?

The reply of the manufacturer has invariably been that whenever the dental profession comes to know what it wants the manufacturers will supply the demand. This is a subtle answer. Their wide acquaintance with the dental profession convinces them that there is no

immediate danger of their being called upon to fulfil this promise. They know that it would require an education campaign of so intensive a nature and so wide a scope to accomplish this end that no single dentist, nor any group of dentists, could afford to launch it. Let us frankly admit that the dental profession as a whole does not yet understand the problem. Let us also face the fact that there is need of additional research before the ground can be entirely cleared for an educational campaign grappling comprehensively with the situation. Comparatively little has been published on the nature of pigmentation in normal teeth, and there are many problems here which remain to be solved.

What is the nature of the pigmentation to be found in the normal tooth? Is this pigmentation confined solely to the dentin? What part does the enamel play in modification of the reflected and refracted rays of light reaching our eyes, and hence in determination of the apparent color of the teeth? And the most comprehensive and fundamental question of all, what does the word "color" really mean? How many adepts and experts can answer these questions? Is it not true that it is the fate of most of us to be half-educated in these matters, so that the most fundamental problems underlying dentistry as a fine art can be answered only by question marks? No one is in a better position to appreciate our feebleness in these matters than the manufacturer. And why should he be expected to assume the initiative in a movement to realize a professional ideal which is quite completely neglected by our educational systems?

Perhaps it may be well to remind ourselves of some of the elementary facts relating to the physical nature of light as a convenient starting-point. Sunlight is composed of innumerable rays of different color, beginning with the red at one end of the spectrum and passing by gradual transitions thru orange, yellow, green, blue, etc., until it reaches the violet at the other end. These rays are separated in the spectrum, but in ordinary sunlight they are all mixed together. When this sunlight falls upon any object certain rays are usually absorbed by the object, while others are reflected. It is these reflected rays which enter the eye and stimulate the retina; by so doing they give color to the object in accordance with the nature of the rays reflected. When sunlight strikes a red rose, all the rays with the exception of the red rays are absorbed. The red rays are reflected, and by stimulating the retina in their characteristic fashion give to the rose its red color. In the same way the stem and leaves absorb all but the green rays, which are reflected and produce the green color that is their characteristic. My English perennial garden at home contains plants of all the variegated colors to be found in the spectrum. As twilight approaches and sunlight disappears, outlines of all the flowers can be seen distinctly, but the colors appear merely as the various shades of gray. When sunlight falls on some object which absorbs all the rays as tho disappearing in a deep well, that object appears black. If, on the other hand, all the rays be reflected in proportion in which they are found in sunlight itself, then the object appears white. White sunlight is broken up by the spectrum into its constituent parts, thru the bending or refraction of these parts at different angles, as is shown in the experiment of Sir Humphrey Davy. The spectrum thus produced consists of pure hues, as distinct from the hues of the landscape for example, which are always modified by a mixture of white or gray.

I cannot here speak adequately of the effects of illumination, the nature of the environment, etc., matters which would take us too far afield in the domain of physics, the anatomy and physiology of the eye, and even the science of photochemistry. I will instead confine my remarks to a discussion of those color-

phenomena which have a direct bearing upon the teeth. The psychologist recognizes three different aspects of color: hue, degree of saturation, and brightness or illumination. By hue is meant position in the scheme of the spectrum colors, as redness, yellowness, etc. We never see a pure spectrum hue, however, in the human teeth. By saturation we mean purity of hue. Any divergence from the pure hue of a spectrum color is either in the direction of an admixture of white, giving us a lighter tint of the same, or in the direction of black, giving us a darker shade, or else in the direction of a gray of the same brightness as the original hue, giving us the effect of dilution merely, or what is called technically a lesser degree of saturation. Brown, for example, is a shade of red, while pink is a lighter tint of the same color. By the addition of black, or white, or gray, therefore, we merely dilute the hue without altering its character as a hue, since black and white are not called hues, but only brightnesses.

In order to be in a position to imitate correctly the color of human teeth, it is first necessary to understand the character of the hue or hues which these embody and reflect. This raises at once the question of pigmentation. The color to be found in the hair, skin and eyes, is due to the presence of what are known as pigment granules. It has been determined that the entire difference between the lightest blonde and the darkest brunette, between the Scandinavian and the Ethiopian, rests solely on the number of these granules found in the pigment cells. The development of these granules and the increase in their number may no doubt be caused by the stimulating action of the sun and wind, and be to a certain extent the result of natural selection, markedly so in the case of the lower animals. Many volumes have been written on favorable coloration in the animal world. The stripes of the tiger constitute a protective coloration, enabling his body to blend with the colors of the jungle. Birds of the most brilliant plumage mate the earliest. Pollen-carrying insects show a preference for brilliant hued flowers. The development of color thus has a meaning in aiding the perpetuation of the species or as a protection from the elements. But why should the teeth have developed color? They are not subjected to the elements in a way that would demand pigment protection. Nor does it seem likely that the motive of attraction thru favorable coloration should have played an important part. The incisal third, the part most clearly exposed, has the least color. Yet we know that the teeth do have color.

If it could be shown that the color found in the teeth was of a different character from that found in the skin, that the presence of color pigmentation in the teeth was due to causes different from those which have determined color pigmentation in the skin, hair and eyes, then we would be in a position to rule out one hypothesis which is indeed natural and plausible, namely, that there ought to be some general harmony between the coloration of the teeth and that of the skin, etc. The considerations just adduced seem to argue the absence of any biological reason why there should exist such a harmony, and the question seemed one which ought to be submitted to the test of scientific inquiry. At my request this problem has been investigated by the department of biology of the University of Minnesota. Teeth from subjects of different races, (Caucasian, Ethiopian, Semitic) were prepared and examined for pigment granulation. None whatever was found. The investigation was carried on with scientific precision, but owing to the important bearing of our negative results, it would be well to await a fuller verification of them at the hands of other scientists. Should these results be established, there would be left but one other explanation for the presence of color in the teeth, namely, that it has its source in the

same factors as those which give color to the internal organs, and the tissues lying beneath the skin. Here the development of color is due to entirely different causative factors from those which determine the development of pigment granules. In most instances this coloration is thought to be due to some special chemical element present on the tissue, such as haemoglobin in the blood, the bilirubin and the biliverdin in the bile, or the fatty globules in the pink belly of the salmon.

Applying at this point our knowledge of the embryology of tooth development, we arrive by a parallel source of reasoning at the conclusion that the source of color in human teeth is similar to that of the internal organs. The only portion of the teeth developed from the skin is the enamel, in which the proportion or organic matter is negligible. It may be stated here as a fact that the enamel contributes only white or gray values to the coloration of the teeth. In other words, its effect is to dilute the hue found in the dentin. It is to the organic portion of the dentin, therefore, that we must look for a determination of the hue natural to the teeth. Unlike the enamel, which is a product of the surface epithelium and is of ectodermic origin, the dentin is generated from the connective tissue and is therefore of misodermic origin.

There is still another consequence of importance which would follow from the absence of any biological relationship between the coloration of the teeth and that of the skin. Many different factors contribute to determine the coloration of the skin, such as racial traits, natural selection, climate, exposure to the elements; hence the skin might be expected to exhibit a great variety of hues. But the coloration of the internal organs depends on only one factor, and hence is simple and uniform. Blood is always red and bile is always green. Variation in tint and shade and degree of saturation naturally obtains, but the fundamental hue is always the same. It would be an important consideration if this could be proved of the dentin of the teeth as well. And if we could determine just what is the nature of the substance which gives color to the dentin, we would be in a position to speak with authority in attempting to describe the color of the teeth. I have not yet been able to carry on the investigation necessary to a settlement of this question, but I can nevertheless report the results of certain tentative experiments for whatever they may be worth. Sections of the same teeth that were examined for the presence of pigment granules with the negative results referred to above were subjected to polarization to determine with physical precision the nature of the hue reflected. The result in every instance was some tint or shade of orange. As is well known, we have usually called this elusive hue yellow. This may be explained partly on the ground that orange is a hue midway between red and yellow, or perhaps more definitely by the deficiency that exists in our color terminology. While we have a name for orange, we have no specific symbol for its lighter tints. The want of a symbol usually has great influence on both our observation and description. It is only the exceptionally acute observer who is able to see and fix something which does not correspond with what has already been fixed and standardized in the common experience of the race, thus receiving a symbol for itself. When the terminology is hazy, the observation as well as the thinking is likely to be equally hazy. If we take a saturated sponge and successively dilute it until we get either lighter and lighter tints or darker and darker shades, is it likely that the faint reminiscence of the orange hue remaining would be identified for what it really is. We would undoubtedly call it yellow. But yellow is not a tint of orange, which is in the spectrum a hue midway between red and yellow. Thus there has arisen a mistaken de-

mand for yellow teeth. The manufacturer has, of course, no more knowledge of the color of teeth than the dentist, nor can he be expected to have. He supplies us therefore with yellow teeth because that is the language in which we coach our demands. A sickly hue, known as chrome yellow is to be found in most teeth of American manufacture. There is an illusion that there is something of blue in the incisal third of the teeth. There is no blue there, but the shade which we perceive is due entirely to the reflection of the dark oral cavity thru the thin incisal edge. Its intensity depends on the amount of dentin between the buccal and lingual enamel plates, which accounts for its entire absence in teeth worn down as a result of an end to end bite or as the result of advancing age. I have no hesitancy in saying that there is no blue pigment to be found in human teeth. On the other hand there are upward of seven hundred distinguishable degrees of gray, from whitest white to deepest black, while the language recognizes only five different symbols for this vast variety—white, light gray, gray, dark gray, and black. It is a few of these seven hundred grays, mixed with more or less of orange, that we call blue.

It is a very simple matter to verify the foregoing statement. By obtaining a box of water-color pigments, such as are used in the schools, and experimenting with different shades and tints of blue, we can compare the results with the natural teeth.

Color sensibility is, of course, innate in all human beings, as it also is in most of the lower animals. But it needs to be cultivated in order to create an interest in the subject sufficient to lead to a discrimination of the finer tints and shades to be found in the teeth, and such training should be made a part of the curriculum of our dental colleges.

Thus far I have dealt chiefly with the color due to the dentin, and with the enamel as contributing white or gray values modifying the saturation of the underlying orange hue of the dentin. I have said nothing about the effect upon the color of the teeth that might be produced by the refractive or prismatic power of the enamel. It is well known that wet enamel is translucent. To what extent light is refracted in its passage thru the enamel, and what effect this could have upon the appearance of the teeth I do not know. My opinion is that the effects traceable to this cause would be very slight, if not altogether negligible. It is certain, however, that the checks in the enamel, breaking the surface up into sections, have a very decided effect; on rare occasions when the checks in question are very pronounced the consequence is a prismatic effect similar to that produced by a leaded glass window. This suggests the important fact that the character of the surface determines the manner of its reflection of the light which falls upon it. When light falls upon a polished surface it is reflected in a solid beam, and produces a whitish effect. When it falls upon a rough surface the rays of light are dispersed thru a variety of angles of reflection and the object looks darker. Thus it will happen that two objects of the same fundamental hue will appear to be of different degrees of brightness and saturation, depending upon whether the surface is rough or smooth. This fact is of practical importance in matching human teeth. With one exception American manufacturers supply us with teeth that are smooth and highly glazed. In a large percentage of natural teeth the enamel surface is somewhat irregular, due, according to Pickerel, to a failure in development at the ends of the enamel reds. By rubbing a lead pencil over the enamel this fact may be demonstrated in the production of a stippled appearance.

There are other color phenomena which are not due primarily to the teeth themselves, but to the environment, and so affect the apparent color of both natural and artificial teeth. These

phenomena must be taken into consideration when matching. Most important of these are the phenomena of color contrast, both simultaneous and successive, the latter being usually called negative after images. After looking for some time at a red spot, and then withdrawing the eyes to rest upon a colorless or gray surface, the red spot will have been replaced by one of greenish hue. The phenomenon may also be reversed, passing from green to red. These two colors are complementary, and any prolonged excitation of the retina by one of them will tend to induce the retinal process corresponding to the other. A similar relation holds between blue and yellow. This phenomenon can also be made simultaneous by introducing into the visual field a strip of neutral gray, upon which the contrast effect will be visible, due to the close juxtaposition of the colors.

The result of these phenomena is that the orange teeth may be given a tinge of green as a contrast effect from the surrounding healthy red tissue. This is especially noticeable in people with thick red lips.

Some manufacturers have made the mistake of putting a slight tinge of green paint into the teeth themselves, which is, of course, quite unnecessary and unduly exaggerates the natural effect. When two complementary colors are placed alongside of one another the effect of simultaneous contrast is to deepen the value at the line of junction, making the red more red and the green more green, or in other words increasing their saturation. If we pass rapidly back and forth from one color to another, these various contrast effects set up compensatory stimulations which make discrimination difficult. I have experienced this in selecting teeth from a large tray, where all the various hues were represented. It is a part of the same phenomenon that a bright object appears much brighter when it is placed alongside of or on a background of some darker color, and vice versa. Thus the bright teeth mounted on a dark background of wax by the manufacturer appear brighter than they really are.

Still another interesting element enters into the situation to complicate the matching problem. Those who have offices which admit direct sunlight during certain hours of the day will appreciate the effect of illumination or brightness in changing the apparent hues of the teeth. When highly illuminated the red end of the spectrum gradually changes to orange and with increasing brightness further changes take place to yellow and white. The blue end becomes gray under increased illumination. Conversely, if the spectrum is darkened, the red end changes toward brown or black and the blue end will also begin to look black. The effect of high lights and shadows upon the foilage of trees is similar. Near at hand the leaves may look green, but when we see them from a distance the leaves have a silvery gray appearance, and still others actually appear blue. These differences are due to the way in which the surfaces of the leaves are illuminated. In matching teeth, therefore, the kind and amount of illumination has to be carefully considered. Because of their position in the mouth, surrounded as they are by the red lips, having for a background the more or less dark oral cavity, the natural teeth will be effected by factors entirely different from those which determine the apparent color of artificial teeth, which are held in the hand or by tweezers in front of the mouth, not even the shadow of the lips obstructing the illumination. This is especially true when we attempt to match a single facing. Hence it is best, in order to be sure of securing a match, to defer the selection of the tooth until the tooth to be crowned is ground off sufficiently to allow the facing to be placed in the

exact position it is to occupy in the mouth.

The same serious mistakes have been perpetrated again and again in successive issues, with what might be regarded as a surprising indifference to the aesthetic requirements of our patients and the needs of the dental profession. In teeth manufactured in America, for example, the color, such as it is, is not properly distributed. It is placed in the gingival third, and the degree of saturation is uniform thruout, instead of following the natural variations. It follows from this practice that even after we may have succeeded in obtaining a tooth of approximately the right hue, in those cases where it becomes necessary to grind off a considerable part of the facing, as is often the case, the color is eliminated by the grinding process. Again, the texture of the porcelain is far from being lifelike. This results from the fact that the teeth are made with a biscuited body and an enamel covering, producing a granulated appearance, utterly unlike the natural appearance of human teeth. But the primary defect of all is, of course, due to the difficulty of properly identifying the exact character of the color hues to be found in the natural teeth.

I have tried to indicate a few of the factors that enter into the solution of the problem of securing artificial teeth that satisfactorily represent or imitate nature. For the individual dentist, the requisites that seem to me of prime importance in this connection are: more complete information that is usually possessed on the nature of color, a more adequate training of his native powers of color discrimination, and an understanding of the various elements which enter into the apparent color of the teeth under different circumstances of illumination and environment. In proportion as our skill and knowledge enable us to solve this problem more satisfactorily, we are likely to feel more and more the joy and stimulus of artistic success. Such an experience is more than an individual satisfaction. It is also the best guaranty for the future of the profession, that the instinct of good workmanship shall not be atrophied, but continue to work for improvement and progress.

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FORMATION OF ROOT-CANALS IN HUMAN TEETH[1]

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THERE are already a number of treatises by various authors upon the anatomy of the root-canals of human teeth. Upon examination these works readily show that they are based upon material which in many ways does not suffice to determine conclusively the influences of age and development upon the form and number of root-canals. Excepting the work of Fischer, no other work has appeared which has more than briefly treated the anatomy of root canals of human teeth. Furthermore the statements of various authors are not universally accepted and have been corrected in many cases. The upper and lower incisors, cuspids, first and second bicuspids, with the third molars have been left unconsidered thus far. I shall present my observations made upon twenty-eight hundred specimens treated by a new method. I shall discuss the shape, size, number, and bifurcations of the canals in the apices tooth type. Also I am including many cuts of casts taken from teeth at different stages of life in order to make the work more comprehensive as well as to afford a working basis showing all the details upon which questions might arise.

During the last three years I was able to collect a great number of teeth—about three thousand—which I examined by the method suggested, with the help of my honored teacher, Dr. Stoppany, and a few dear associates. The greater part of the material used in the study was derived from military dental clinics during my own professional attendance.

Historical Note

In looking over the literature dealing with dental anatomy no statements will be found dealing with the apical anatomy of root-canals up to 1891. Most of the authors restrict their work to the external description of root forms. The most accurate description of root-canals with respect to their number and course was given by Carabelli in his textbook in 1844 in which he also included cuts of the pulp chambers. In the later publications we not only find no new additions concerning the character of the root-canals but even the statements of Carabelli, have been forgotten entirely, so that there is practically nothing concerning the anatomy of root-canals in the works of Wedls (1876), Charles Tomes (1880), and Baumes (1890). Muehlreiter (1891) was the first to undertake this study at all thoroly and he recorded various observations which have been shown to be correct by the casting method. In Boedeker's *Anatomy and Physiology of the Teeth* we search in vain for references concerning the anatomy of root-canals. Coulliaux (1896) only mentions Carabelli's work in his *Anatomy, Physiology and Pathology of the Dental Pulp,* while Miller (1903) in his *Conservative Dentistry* indicated the importance of an intimate knowledge of the anatomy of root-canals and included a few cuts of ground speci-

[1] "Zur Anatomie der Wurzelkanale des menschliches Gebisses," *Schweizerische Vierteljahrsschrift fur Zahnheilkunde,* 1917. Translated by Newton G. Thomas, A.B., M.A., D.D.S., and Herman Redlich, Chicago, Illinois.

mens which showed the variations of form and course of the canals. In general we have satisfied ourselves that the root-canals are complex and that a thoro knowledge if them is important, also, that the filling of marrow and crooked canals was impossible. Preiswerk (1901) is the first one who determined that the root-canals of human teeth are much more complex in structure than often thought. By means of metallic specimens of corrosion, he determined that there exists a great variability in form, number, and branching in the root-canals. Altho the results of his work are not accepted everywhere without contradiction, the method objected to, and the results looked upon as products of art, this valuable work has aroused further research in this field. A few years later Fischer (1908) made a number of observations by means of a new method, using a dilute celluloid fluid to bring out the delicate branchings of the root-canals, making observations on a wider basis upon human and animal teeth. He determined the physiological and pathological influences connected with the formation of root-canals and the branching at their apices as well as showing by means of macroscopic and microscopic preparations how greatly the anatomy of root-canals is differentiated by means of delicate branchings, communications, and spaces within the tissue. With respect to the different types of teeth, he determined according to his own observations by means of a percentage under what conditions the branchings occur, and finally concluded that on account of the complicated structure a complete removal of the pulp is impossible in upper first, second, and third molars and in the mesial roots of lower molars and upper bicuspids. In further observations in which by means of a simple lens Fischer determined the numerous apical branchings as fine canals at the apex of the tooth without further examining the anatomical details, he dealt with the arrangement of the branchings at the apices of different teeth.

In the course of time, the results of Fischer's were pronounced as artistic products, especially were the apical branchings pronounced incorrect, and also several statements regarding the form of root-canals, as for example that of the distal root of upper molars, and similar statements with regard to the form of upper and lower incisors, cuspids, and first and second bicuspids, which were not examined in sufficiently large numbers.

Additional observations with respect to the anatomy of the pulp chamber and root-canals were made by Loose, who used numerous ground specimens of single-rooted teeth to illustrate the variations in form and number of the root-canals and especially the topography of the pulp chamber, which were already emphasized by Fischer and here proved as exact statements. The finer apical branchings, however, were not dealt with in his work.

In 1905 the interest of Port became aroused in the examination of separate types of teeth by the observations of Chauvin and Brunsmann (1886). However, without using any exact method he proceeded to examine upper bicuspids and lower molars by means of an ordinary probe and to verify the results of Chauvin, but he came to the same conclusion as Fischer with respect to the number of root-canals, altho he did not determine the delicate structure of the root-canals.

In 1913 Adloff emphasized a new method which was first described by Spalteholz in connection with clarifying nontransparent specimens. Adloff was the first one to attempt to examine the relations of the pulp cavity of the entire tooth by filling the cavity with molten metal and then clarifying according to the method of Spalteholz. No one's results appeared with respect to the anatomy of the root-canals by this method.

Fasoli and Arlotta (1913) likewise

attempted to describe the anatomy of the root-canals by a modification of the technic used by Adloff, but they arrived at the same results as Fischer did, without backing their statements by a sufficiently large enough number of reproductions of the specimens.

Moral (1914) described a new method which consisted in filling the pulpal cavity with Chinese inks and then opening the tissues, according to the method of Krause. By using this method, Moral examined about one hundred teeth, namely upper molars, with respect to the division of the root-canals of the mesiobuccal root and the existence of a fourth canal which he actually found in 63 per cent of the specimens.

A General Description of the Macroscopic and Microscopic Conditions

In my examinations which were made of twenty-eight hundred teeth I have attempted to restrict my descriptions to purely anatomical conditions in the root-canals of human teeth since Fischer had already described the comparative anatomy and pathology of the root-canals in detail. I have used only those teeth for specimens which did not have a removed pulp so that the pathological influences which might have affected the delicate structures of the canals can be excluded. Since the previous observations brought no statements concerning the influence of age on the development of root-canals with reference to their size and form and the number of the reproductions of the conditions present in the root-canal I have arranged my observations to include a large number of specimens to afford a verification of the results of previous authors and numerous reproductions to form a basis for the results as well as an addition to statistics.

It was possible for me to collect teeth varying in ages from five to fifty-five years. In the case of lower first and second molars I was able to collect those from six to seventeen years, while in the remaining teeth I did not go below the age of twelve years and have fixed the first period as that from twelve to twenty years since I was governed by the sort of material at hand which was very difficult to secure. The remaining periods I fixed as twenty to thirty, thirty to forty, and forty to fifty-five.

With reference to the form and number of root-canals of human teeth the material showed in general that during youth the canals are voluminous and give no evidence of complications in structure as long as the apical foramen is not closed. It seems as tho the normal period of differentiation of the root-canals begins very early (to follow Fischer), that is, with the formation of the same, and to a greater or lesser degree according to the various influences of growth. "The roots of the young tooth germ enter the last stages of growth as soon as the tip of the crown penetrates the mucous membrane epithelium of the mouth. While the crown is assuming its place in the arch by gradual growth, the solidification of the root is furthered by additions of cementum and dentin. Next it appears that the apex of the young root still has a wide, spacious foramen which seems to decrease in size gradually as soon as the development of the main mass of the tooth has ended. The feverish activity of the young odontoblasts and pulpal fibrils becomes more moderate and the crown portions of the pulp proceed in development with a lessening amount of nutrition. The difficult point of growth is attributed to the basal portion of the root, where a gradual displacement of the pulp is taking place, due to the spreading out of the hard tissues, namely, dentin and cementum. The addition of these tissues may proceed with more or less irregularity and the pulp be divided forming channel-like extensions between newly formed dentin."

In various human teeth the development of the apical foramen shows, as proved by my specimens, that no branch-

ings take place at the apex during youth, but after closure of the foramen the branching of the pulp appears at the apex. The closure of the apical foramen occurs at quite different times in teeth of the same type. In almost all types of teeth I have been able to determine that the closure of the foramen takes place between the ages of three and five; therefore the addition of dentin is quite irregular.

In most types of teeth (upper third molars excluded) between the ages of twelve and twenty years few apical branches were found; the greatest percentage of branching was found in teeth between the ages of twenty and forty years. In teeth between the ages of forty and fifty-five years having only one root-canal a decrease took place, while those with more than one root-canal showed an increase in apical branches. The marrow canals also showed similar conditions. In young teeth few or no marrow canals[2] were shown, while teeth of from twenty to forty years showed the greatest percentage of marrow canals, namely, those having one root-canal as the upper and lower incisors and cuspids; and in teeth of from forty to fifty-five years decrease was shown. The percentage of marrow canals increased with age in those having more than one root. It seems as though the physiological addition of dentin takes place more rapidly in the single-rooted teeth than in those of more than one root (see statistical table and Plates I-IV). The numbers of the statistical table with regard to the apical branchings and marrow canals in the various periods are only relative since great variabilities occur in the different age periods of human teeth. But considering the large number of examined teeth we can view these figures as approaching very near to the actual conditions.

The observations of Trueb show, with reference to the pulp chambers of teeth, that by the increase in formation of dentin in a physiological sense the wide chambers of the young organism are gradually narrowed by age, for the older a tooth becomes the thicker become the walls. Fischer already called attention to the physiological processes of growth of dentin and dentikel and their importance to the differentiation of the pulpal chamber within the root. Those roots which during the youthful period had wide, flattened walls, as in the lower incisors, and large molars, upper bicuspids and the disto-buccal root of upper molars, according to Fischer, seem to form a branched system of calcium salts by the irregular accumulation of dentin at the opposite lying walls within the pulp of the root, and may appear more complex according to the irregularity in function of the accompanying factors during the process of growth. The physiological activity may reach its highest point by almost completely obliterating the root-canals in senile teeth. Muehlreiter is of the same opinion with regard to the formation of two mesial root-canals in lower molars, which only occurs in old teeth, while, in young individuals there is one large spacious canal.

The fact that in rare cases a finer differentiation may take place in very young teeth has been shown by Fischer, but according to my own observations I have come to regard this statement as exceptional, since in general the young teeth exhibit simply constructed voluminous canals. The upper bicuspids especially, and some roots of the upper and lower molars exhibit differentiation due to the physiological addition of dentin, which may result in the formation of a new separate root-canal, as shown by Moral in the case of mesio-buccal roots of upper molars. My specimens will verify these results.

The formations of the pulpal canal undergo a physiological change during the entire life, according to Fischer. These differentiations according to

[2]Compensatory canals.

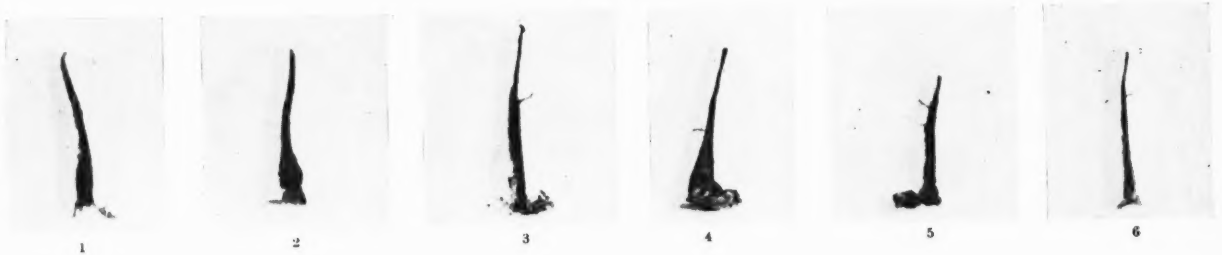
Plate A 1

1 2 3 4 5 6 7

8 9 10 11 12 13

Upper Central Incisors

Plate A 2

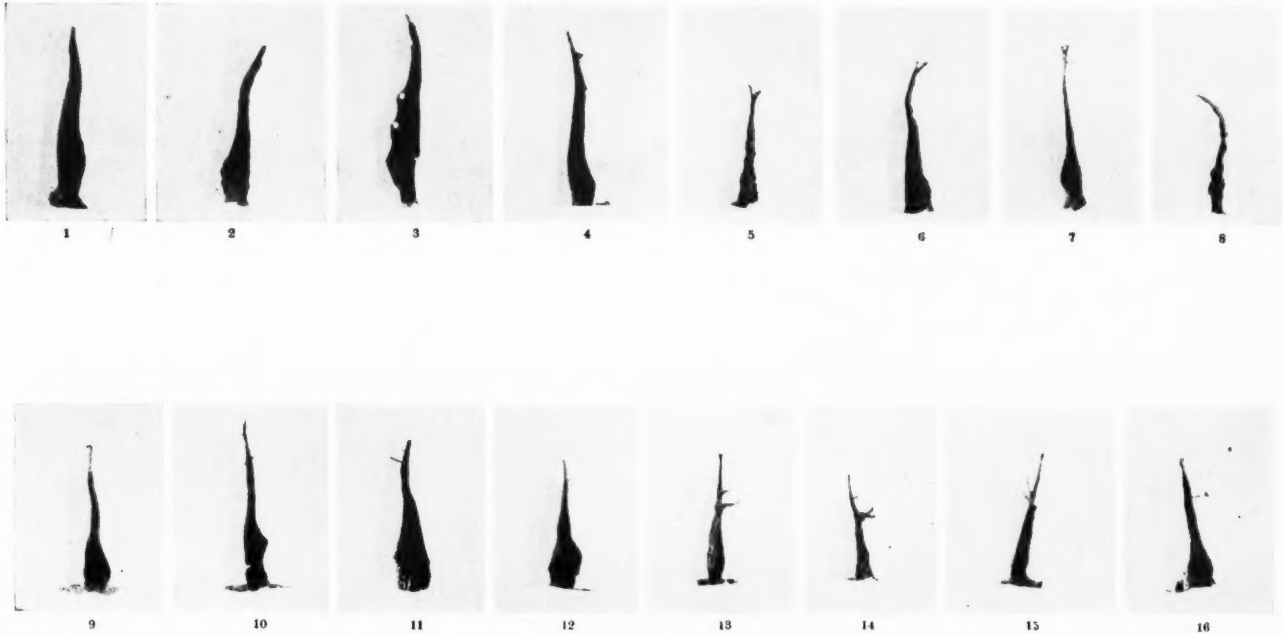


1 2 3 4 5 6

7 8 9 10 11 12

Upper Lateral Incisors

Plate A 3



Upper Cuspids

Fischer appear (1) as simple branches and twigs, lateral extensions and marrow canals within the root dentin, (2) as cross-bridge systems, (3) as island-like parts within the tissue. These differentiations are exhibited in lower incisors and bicuspids as strands of bifurcation and branches at the apical foramen; in the upper incisors as delicate lateral extensions; and those in upper bicuspids and all molars may cause a complicated structure, the result of their more frequent and delicate arrangement.

According to the results of my own observations, I am able to accept the views of Fischer with a few exceptions, which I will touch upon in the description of the results.

By means of numerous reproductions and specimens of various ages, the anatomical relation of all the different teeth will be described with reference to the number of root-canals, apical branchings, and marrow channels.

The influence of age in the gradual obliteration of the root-canals may be seen in various teeth, also the effect upon the pulp chamber, since the various teeth of older life exhibit a narrowing of the volume of the canal, altho not regularly. Great variations may occur in this process of obliteration of the root-canals, but these are teeth of older life which exhibit large voluminous canals, contrary to an expected narrowing, while in some young teeth, of course not very frequently, the beginning of the process of obliteration is noticeably in progress. In this case the pathological conditions described by Fischer are brought to the foreground. In general, then, a lessening of volume of the pulpal canal was found with increasing age, which here and there may lead to a complete obliteration of the canal.

Microscopic Results

In order to determine the delicate microscopic branchings described by Fischer and for the purpose of following out more definitely the marrow canals running from the root-canals to the peridental membrane and the apical branchings already described macroscopically, I have made a series of approximately fifty sections of teeth of all types. Of the fifty teeth examined, forty-eight exhibited apical branchings of various forms. In addition to the macroscopically determined branches, a whole row of canaliculi of the most delicate type were found in the apical regions, often uniting into a system resembling a sieve-like gate of the apex (see Plates a-k).

The marrow canals extend to the peridental membrane from the root-canal thru the root dentin, either singly or as a union of several canals, forming a connecting channel at various levels of the root which is not seldom filled with blood vessels. Besides, numerous lateral extensions occur between the canals.

The mesio-buccal roots of upper molars and the mesial canal of lowers probably exhibit the most branchings. However, the upper third molars as well as the upper and lower bicuspids do not rank far behind the above in their complexity. The incisors and cuspids, both uppers and lowers, in most cases show delicate apical branchings and marrow canals, indicating that these single-rooted teeth are not to be regarded as having simple apical regions.

The narrowing or displacement of root-canals of older individuals by a formation of dentikel likewise determines a complicated condition of the apical part of the root.

The microscopical results verify the conditions of the branching systems of the root-canals of the various teeth already indicated by the macroscopical specimens (see Plates a-k).

A Special Description of the Results of Each Tooth Separately

Upper Central Incisors

The root-canals of the upper central incisors are characterized in general by primitively formed spaces. The root-canals are in conformity with the form

of the root. The crown portion is compressed labio-lingually, exhibiting a wider mesio-distal than labio-lingual diameter, but near the apex it gradually becomes narrower and assumes a more cylindrical form.

In young individuals the canal is quite wide and without complications in structure (Plates I a and I b) or a complete obliteration of the canal would result (Plate c, 6). The decrease in volume of the canal may be clearly seen in Plates I a and I b.

Besides the root-canals, so-called marrow canals also occur. The first one to call attention to this sprout was Preiswerk. He was followed by Fischer, who mentioned the delicate ramifications and tufts which appeared to him especially in lateral incisors; however, he did not discuss them with the aid of specimens. In a later work by the same author he described the conditions at the apical foramen by enlarging the external canals with their ramifications at the apex by means of a probe; however, no specimens or proof by the "corrosion method" were furnished.

According to my own observations which are based upon 280 upper central incisors, I obtained the following results: The upper central incisors possess a main canal. In approximately 25 per cent of the teeth examined one to three apical ramifications of the root-canal were found besides the main canal. In addition to these ramifications or together with them, 20 per cent of the teeth examined exhibited so-called marrow canals which run from the main canal to the peridental membrane thru the root dentin, partly singly in the apical region and partly as a union of several in the upper half of the root (Plate A 1, 6-12, Plates I a and I b, 32-51, Plate i, 17.)

The young teeth, often to twenty years, showed neither apical ramifications nor marrow canals; those of twenty to forty years showed the greatest percentage of such differentiations, while teeth of forty to fifty-five years showed a decrease in ramifications, probably due to the increased narrowing of the canals. The results are expressed in Table 1.

TABLE 1. UPPER CENTRAL INCISORS

Age	Number	Number of Root-Canals		Number of Apical Branchings					Percentage	Number of Marrow Canals				Percentage
		1	2	1	2	3	4	5		1	2	3	4	
10-20	20	20	.....	2	.....	.....	.....	.....	10	.....	.....	.....	.....	....
20-30	190	190	.....	40	.....	10	.....	.....	20	40	5	.....	.....	23
30-40	40	40	.....	10	.....	2	.....	.....	30	8	2	.....	.....	25
40-55	**30**	**30**	.....	5	.....	.....	.....	.....	**16.6**	4	1	.....	.....	**10**
	280	280	.....	57	.....	12	.....	.....	25	52	8	.....	.....	21.4

UPPER LATERAL INCISORS

The root-canals of the upper lateral incisors in general show the same conditions as the upper central incisors, except that they are somewhat less spacious and generally correspond to the form of the root.

With reference to the development of age we notice the same conditions in the upper lateral incisors as in the upper centrals, namely, a decrease in the volume of the root-canals with age, and the presence of apical ramifications and marrow canals. In addition to the main canal there are ramifications in the apical portion of the root and marrow canals which form a connection between the main canals and the peridental membrane (Plate e, 10).

Out of 248 examined upper lateral incisors, 77 showed apical ramifications, that is 33 per cent. With respect to the upper centrals there is an increase in apical ramifications. The marrow canals also show a small increase over

those of the upper centrals, the percentage being 22 per cent and mainly distributed in the twenty-to-forty-year-old group (Plates II a, II b, A 2). The results are summarized in Table 2.

TABLE 2. UPPER LATERAL INCISORS

Age	Number	Number of Root-Canals					Number of Apical Branchings					Percentage	Number of Marrow Canals					Percentage
		1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	
12-20	22	22	.....	.....	.....	.....	2	.....	.....	.....	.....	9	.....	.....	.....	.....	.....	....
20-30	140	140	.....	.....	.....	.....	42	8	.....	.....	.....	36	28	6	.....	.....	.....	25.5
30-40	60	60	.....	.....	.....	.....	16	3	.....	.....	.....	30	15	3	.....	.....	.....	30
40-55	26	26	.....	.....	.....	.....	5	1	.....	.....	.....	23	4	.....	.....	.....	.....	15.5
	248	248	.....	.....	.....	.....	65	12	.....	.....	.....	31	47	9	.....	.....	.....	22

UPPER CUSPIDS

In general the root-canals of the upper cuspids are in conformity with the form of the root. These canals are more spacious than those of the upper incisors and the labio-lingual diameter is greater than the mesio-distal diameter. The young upper cuspids in particular have a large spacious root-canal which, however, with the influence of age is narrowed down by the physiological addition of dentin into a finer canal (Plates III a and III b).

In the apical region of the root-canals of the upper cuspids delicate ramifications are found which are much simpler in form than those of the upper central incisors. Usually the main canal divides into two side canals in the form of a fork, of which one side usually opens externally slightly coronal to the apex and palatinal as already determined by Fischer by means of a probe (Plate A 3, No. 4-7). Outside of the apical ramifications there are likewise marrow canals found traversing the root dentin in the upper half of the root mostly and running from the main canal to the peridental membrane often as one or two united (Plate A 3, 7-12, Plates III a, III b 10-20, 30-40).

In examining 154 upper cuspids, 39, that is 25 per cent, showed apical ramifications the greater percentage between the ages of twenty and forty, and 28 of the 154 showed marrow canals, that is 18 per cent. There is a general decrease in the percentage of both the apical ramifications and marrow canals in upper cuspids with respect to the upper incisors. The exact relation of figures is shown in Table 3.

TABLE 3. UPPER CUSPIDS

Age	Number	Number of Root-Canals	Number of Apical Ramifications		Percentage	Number of Marrow Canals		Percentage
		1	2	3		1	2	
12-20	40	40	3	....	7.5	....	....	....
20-30	69	69	20	3	33	13	3	33
30-40	30	30	8	2	33	6	3	30
40-55	15	15	2	1	20	2	1	20
	154	154	30	6	25	21	7	18

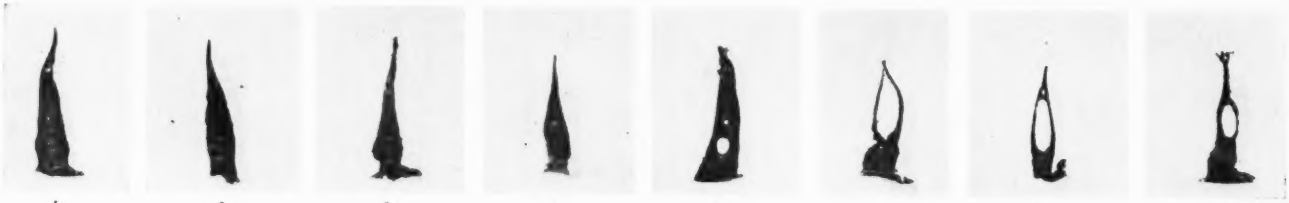
LOWER CENTRAL AND LATERAL INCISORS

While there are few statements in literature concerning the detailed anatomy of the upper incisors and cuspids, and there is an absence of any exact description concerning their apical ramifications and marrow canals accompanied by specimens, there are statements concern-

Plate B 1

Lower Central and Lateral Incisors

Plate B 2



1 2 3 4 5 6 7 8

9 10 11 12 13 14 15

Lower Cuspids

ing the lower incisors by Carabelli, who states that their root-canals may exist either as one main canal or it may be split into a double canal in the lower part of the root, making either one or two exits. These statements were also verified by Baume, Caulliaux, Mettnitz, Muehlreiter, Hattyasy, Scheff, and Fischer.

There is a frequent division of the root-canals of the lower central and lateral incisors, contrary to the upper incisors in which the canals are single. Loose determined by means of numerous ground specimens of lower incisors that it is not infrequent that branches of these canals are formed by means of a mesio-distal septum of dentin whereby the simple canal divides into a labial and lingual canal which may again unite at the end of the septum and open at the apex in a single mouth or as two separate exits. The root-canals of the lower incisors in general appear constricted mesio-distally corresponding to the form of the root. During the youth period these lower incisors present simple, voluminous canals without either bifurcations or apical ramifications (Plate IV a, 1-21, Plate B 1, 1-4). The differentiations of the root-canals first occur after the closure of the apical foramen, when an addition of dentin takes place within the canal on the mesial and distal sides corresponding to the external mesial and lateral grooves in location, which makes the canal so narrow as to cause the mesial and distal inner walls to meet, forming a septum of dentin which divides the main canal into a labial and a lingual canal. This septum may stretch along the whole length of the canal or only partly, in which cases a penetration of this septum will be found in a greater or lesser degree forming a bridge system between the two canals. Usually the two separated canals will again unite shortly before reaching the apex and end as a simple canal (Plate B 1, 5-9, Plates IV a and IV b, 35-53).

In addition to this method of division there is another manner of division in which the main canal first divides in the apical third and represents a forklike arrangement in which case the canals end separately and no second union takes place. In older teeth these canals may be narrowed or obliterated by additions of dentin, so that in place of two former canals only one persists. In general, these canals show a considerable decrease in volume (Plates IV a and IV b).

Besides the bifurcation the lower incisors also show apical ramifications but in a much less degree than in the upper incisors and the marrow canals are also less frequent. Fischer examined 36 lower incisors and in 53 per cent he found bifurcations. I am unable to state from my observations whether or not the apical branches always occur plurally.

Out of 136 lower incisors I examined I found 50, that is 37.6 per cent showing bifurcated root-canals; the rest showed only one canal. Apical ramifications were found in 30 per cent and marrow canals only in 10 per cent. There is a decided decrease in the percentage of apical ramifications and marrow canals in the lower incisors as compared with the upper (Table 4).

TABLE 4. LOWER CENTRAL AND LATERAL INCISORS

Age	Number	Number of Root-Canals					Percentage	Number of Apical Branches					Percentage	Marrow Canals					Percentage
		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
12-20	30	26	5	....	....	....	16	.....	....	....	....	....	....	....	....	....	....	....	....
20-30	60	30	30	....	....	....	50	152	....	....	....	....	28	6	1	....	....	....	11
30-40	32	20	12	....	....	....	37	102	....	....	....	....	37	4	2	....	....	....	20
40-55	14	10	3	....	....	....	22	30	....	....	....	....	22	1	....	....	....	....	7
	136	86	50	....	....	....	37.6	284	....	....	....	....	21	11	3	....	....	....	10

Lower Cuspids

The lower cuspids, contrary to the upper cuspids which have a simple undivided canal greatly resemble the lower incisors in differentiations of the root-canals. In the case of a simply constructed canal the canal in general corresponds in form to the form of the roots, and the labio-lingual diameter is greater than the mesio-distal.

During the first period the root-canals are quite voluminous and simple in structure without apical ramifications or marrow canals, while here and there indications of a bifurcation are noticed (Plates V a and B 2). Later in life bifurcations appear in the root-canal by a formation of dentinal bridges mesio-distally which lead to the formation of a septum and causes a division of the main canal into a labial and lingual canal. Altho Fischer still speaks of a simple canal, Loos had demonstrated the bifurcation in many specimens which results my own findings support (Plate V b, 31-52). This bifurcation of the root-canal into two, in which case there is also an external splitting of the root, results in two apices besides which bifurcations there are also those which show a bifurcation in the apical third resulting in a forked canal but having a simple canal in the incisal two-thirds (Plate B 2, 12-15). Besides these differentiations there are also the delicate apical ramifications and marrow canals (Plate c 5, Plate h, 15). Apical ramifications are found in the simply constructed canals as well as in those having the divided canals, and in the latter case after their union just short of the apex they split up into short twigs, in which case it is not uncommon that the main canal opens somewhat coronal to the apex of the root (Plate B 2, 8-15).

The reduction of volume of the root-canals of young teeth up to the oldest is shown in Plates V a and V b.

Out of 125 examined lower cuspids, 54 or 43 per cent showed bifurcation, 39 per cent showed apical ramifications, and only 12 per cent showed marrow canals. The result of examinations according to the different periods is given in Table 5.

Table 5. Lower Cuspids

Age	Number	Number of Root-Canals					Percentage	Number of Apical Branchings					Percentage	Number of Marrow Canals					Percentage
		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
12-20	15	14	1	....	....	....	7	1	....	....	....	....	7	2	....	....	....	....	13.3
20-30	63	30	33	....	....	....	55	25	4	....	....	....	40	4	2	....	....	....	25
30-40	30	16	14	....	....	....	46	12	3	....	....	....	50	2	2	....	....	....	14.5
40-55	18	18	6	....	....	....	33	4	....	....	....	....	31	1	1	....	....	....	11
	126	78	54	....	....	....	43	42	7	....	....	....	39	9	5	....	....	....	12

Lower First Bicuspid

The root-canals of the lower first bicuspid are mostly simple in structure, corresponding to the root in form. According to Muehlreiter a bifurcation may take place due to a lateral grooving of the root, with the result that two separate prongs may persist. In this case there is also a splitting in the root-canal into two delicate canaliculi. Fischer states that two root-canals may exist during lateral grooving of the root and that these canals may either end separately or join again shortly before the apex and then break up into delicate ramifications.

During youth the canal is simple in structure and voluminous, and gradually diminishes in size toward the conical apex (Plate VI a). In older teeth the root-canal volume is reduced and exhibits apical ramifications, as well as marrow canals which consist of one or

two side channels leading from the main canal to the peridental membrane thru the root dentin at various levels. I was unable to determine a bifurcation of the root in my observations; I found only a slight indication thereof (Plates VI a and D 1).

Out of 75 examined lower first bicuspids, 2 or 2.3 per cent showed indications of a bifurcation, 44 per cent showed apical indications, and 17.3 per cent showed marrow canals. The results of my observations are summarized in Table 6.

three canals will be present (Plates VI b and D 2, 6-12). Usually the bifurcation takes place in the apical region of the root in which case the canal breaks up into a number of fine branches.

In young teeth neither bifurcations nor apical ramifications appear and the canal is of simple structure and voluminous. In older teeth there is the usual reduction in the volume of the canal and the appearance of apical ramifications and marrow canals. According to Fischer this branching takes place in 35 per cent of them (Plate b, 3, Plate f, 12).

TABLE 6. FIRST LOWER BISCUSPID

Age	Number	Number of Root-Canals					Percentage	Number of Apical Branchings					Percentage	Number of Marrow Canals					Percentage
		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
12-25	10	10	....	....	....	....	....	1	....	....	....	....	10	....	....	....	....	....	....
25-35	40	39	1	....	....	....	2.5	16	5	....	....	....	52	7	1	....	....	....	20
35-45	25	24	1	....	....	....	4	9	2	....	....	....	44	4	1	....	....	....	20
	75	73	2	....	....	....	2.3	26	7	....	....	....	44	11	2	....	....	....	17.3

LOWER SECOND BICUSPID

The lower second bicuspids show conditions similar to those of the lower first bicuspids. The root-canals are simple in structure but somewhat more spacious than those of the lower first bicuspids. In addition to a simple cylindrical canal, which gradually diminishes toward the apex, there may also be a bifurcation of the root-canal, as already stated by Fischer. According to my specimens, this bifurcation takes place in the apical half of the root in the form of a fork, and of these two canals, one may again bifurcate, so that

Out of 65 lower bicuspids which were examined, 5 or 7½ per cent showed bifurcation of the root-canal, 49 per cent showed apical ramifications and 20 per cent showed marrow canals. The result of investigation according to the various ages is given in Table 7.

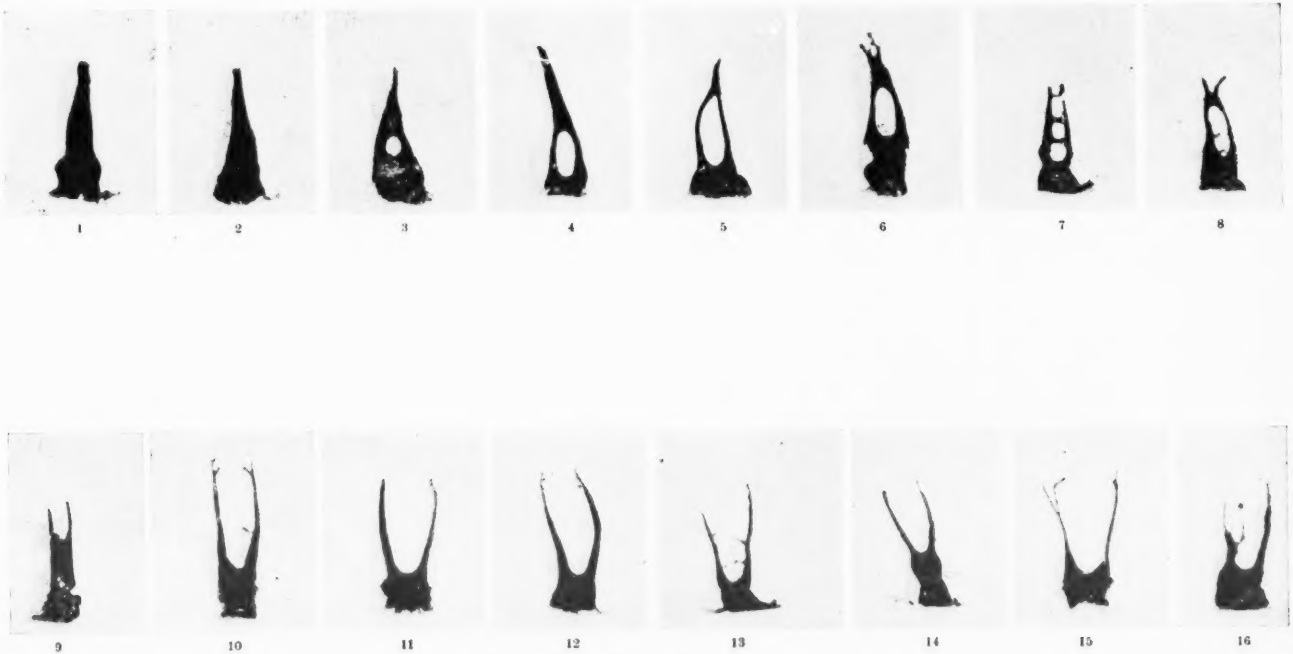
UPPER FIRST BICUSPIDS

The upper first bicuspid usually has two roots, which, however, may be fused and result in a single root. Occasionally a three-rooted form may be found, and in this case the buccal root usually divides into two, while the like is not noticed in the lingual root (Baume).

TABLE 7. SECOND LOWER BICUSPIDS

Age	Number	Number of Root-Canals					Percentage	Number of Apical Branchings					Percentage	Number of Marrow Canals					Percentage
		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
12-25	5	5	....	....	....	....	....	1	....	....	....	....	20	....	....	....	....	....	....
25-35	34	32	2	....	....	....	6	16	2	....	....	....	53	6	....	....	....	....	18
35-45	26	23	3	....	....	....	11	13	1	....	....	....	45	7	....	....	....	....	27
	65	60	5	....	....	....	7.5	30	3	....	....	....	49	13	....	....	....	....	20

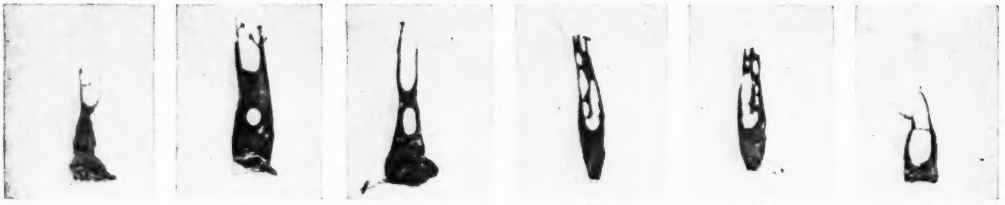
Plate C 1



Upper First Bicuspids

Plate C 2

1 2 3 4 5 6 7



8 9 10 11 12 13

Upper Second Bicuspids

In general there are two roots of which one lies to the buccal and the other to the lingual. In the case of a three-rooted upper first bicuspid, there is a corresponding division of the root-canals, in which the buccal canal divides into two resembling a fork (Plate XI b, 50-53, Plate C 1, 15-16).

The two-rooted bicuspids always have two root-canals and the single only one, which is usually somewhat compressed laterally. Often, however, the single-rooted upper first bicuspids show two canals which separate to the apex.

In the upper first bicuspids we find similar extensions of the root-canals as in the lower incisors and cuspids. In young individuals, the root-canals of two-rooted bicuspids are simply constructed, spacious canals. These canals are separated into a buccal and lingual canal in bicuspids of fused roots by the formation of a dentinal wall mesio-distally during the lapse of years. According to Loos, this separation occurs as the result of the formation of a dentinal wall which forms symetrically against the pulp with a convex surface. This division may take place at various levels of the root-canal.

These two separated canals may unite again beyond the dentinal wall separating them and end in single canal opening at the apex, or a second division may take place after reuniting, resulting in a forklike ending with apical ramifications.

This separation and reuniting of the root-canals, together with the several dentinal walls separating these canals which overlie one another, resembling bridges, complicate the root-canal system of the upper first bicuspids to a great extent (Plate XI a, 11-20, Plate XI b, 31-40, Plate C 1, 2-8).

In addition to this complicated differentiation of the root-canals there are the fine apical ramifications and marrow canals. In single-rooted upper first bicuspids, numerous apical ramifications are shown, and in addition there are marrow canals forming connections between the peridental membrane and the root-canal (Plate f, 11). Similar conditions are noticeable in the two-rooted first bicuspids in which there is also a great tendency toward the apical ramifications. In case of the three-rooted first bicuspids, the buccal canals exhibit delicate apical ramifications (Plate XI b, 52).

Out of 33 examined upper first bicuspids, Fischer noticed 19 or 58 per cent with delicate ramifications.

In counting only the apical ramifications, the result is a lower percentage according to my observations. Out of 260 upper first bicuspids that I examined, 19.5 per cent had only one root-canal, 79.2 per cent had two root-canals, and 1.2 per cent had three root-canals. Forty-one per cent had apical ramifications and only 18 per cent had marrow canals. Table 8 gives a summary of the results.

TABLE 8. UPPER FIRST BICUSPIDS

Age	Number	Number of Root-Canals					Number of Apical Branchings					Percentage	Number of Marrow Canals					Percentage
		1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	
10-20	20	4	16	....	....	....	....	3	....	....	....	13	....	....	....	....	....	....
20-30	160	30	127	2	....	....	....	55	6	2	1	40	20	6	....	....	....	16
30-40	60	11	47	1	....	....	....	21	3	1	2	45	10	5	....	....	....	25
40-50	20	5	17	....	....	....	....	7	1	1	2	55	4	2	....	....	....	30
	260	50	207	3	....	....	....	86	10	4	5	41	34	13	....	....	....	18
		19.5%	79.3%	1.2%														

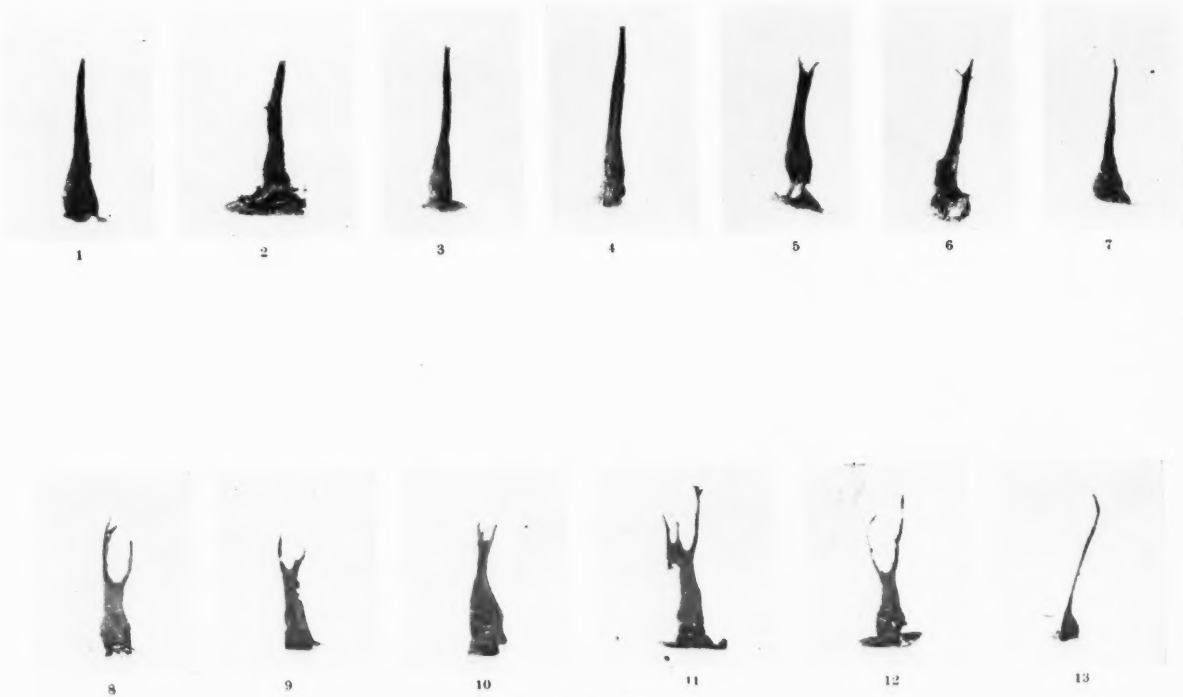
UPPER SECOND BICUSPIDS

In the majority of cases, specimens of the upper second bicuspid show only a simple root, altho some will be found

Plate D 1

Lower First Bicuspids

Plate D 2



Lower Second Bicuspids

with the indication of a bifurcation of the root at the apex, but an extended bifurcation as in the case of the upper first bicuspid is rare.

The root-canals show a great variety in form and number. In the case of a bifurcation of the root, there are always two root-canals. A great number of single-rooted upper second bicuspids also show two root-canals and these may again bifurcate in a forked manner at the apex (Port).

The young type are usually built simply and without ramifications. However, as age progresses the root-canals assume differentiations as were found in the upper first bicuspids. By means of dentinal walls mesio-distally, the canal may be divided into a buccal and lingual canal, which may still be connected by small canals resembling bridges (Loos). The division may occur at any level of the root and may range from a simple connecting canal to a full separation of both canals (Plate XII b, 30-50, Plate C 2, 8-13). These canals open at the apex either simply or in a forked manner with ramifications. Besides these divided canals, there are a great number of simply constructed canals which first bifurcate at the apical third and then give off apical ramifications (Plate XII a and b, 11-30, Plate C 2, 3-8). Port was able to find similar results by examining 53 upper second bicuspids and in 50 per cent he found a bifurcation of the root-canals. Fischer comes to the same conclusion, and out of 33 upper second bicuspids examined, 13 or 40 per cent had two root-canals. In addition to these variations, it is necessary to mention the apical ramifications and marrow canals, the former of which Fischer found to occur in 40 per cent of his specimens (Plate a, 1).

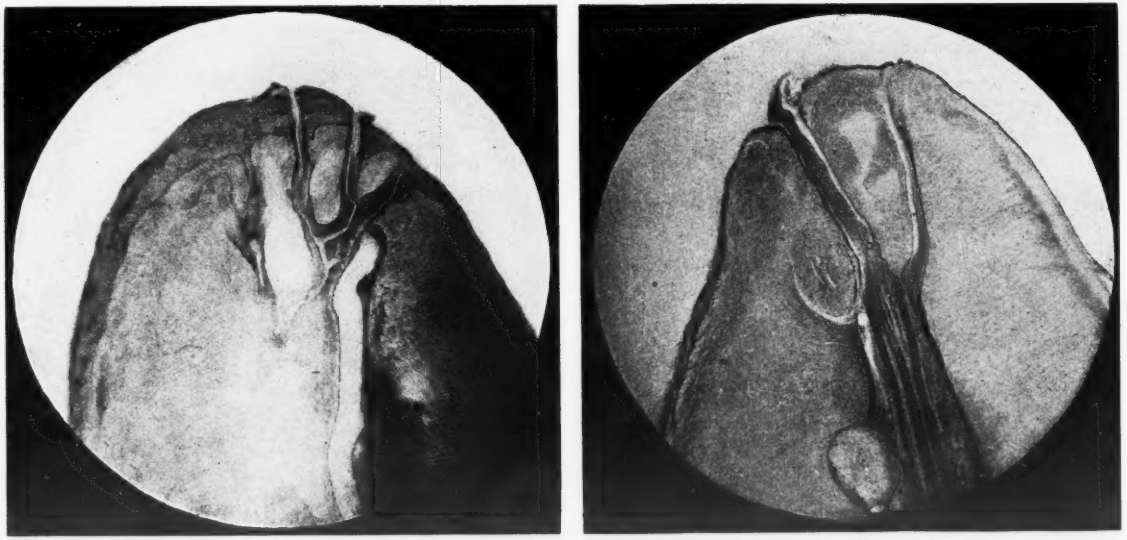
My observations are based on 246 upper second bicuspids, of which 56 per cent had one root-canal, 42 per cent two root-canals, and 2 per cent had three root-canals. Apical ramifications were found in 50 per cent and marrow canals in 19 per cent. (Table 9).

TABLE 9. UPPER SECOND BICUSPID

Age	Number	Number of Root-Canals					Number of Apical Branchings					Percentage	Number of Marrow Canals					Percentage
		1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	
15-20	16	16	....	....	....	....	6	....	....	....	....	37	....	....	....	....	....	....
20-30	156	80	73	3	....	....	64	4	3	1	....	48	22	3	....	....	....	16
30-40	50	29	21	....	....	....	24	2	2	....	....	53	8	2	....	....	....	20
40-50	24	12	10	2	....	....	10	2	2	....	....	61	10	2	....	....	....	50
	246	137	104	5	....	....	104	8	8	1	....	50	40	7	....	....	....	19
		56%	42%	2%														

[*To be concluded*]

Plate a

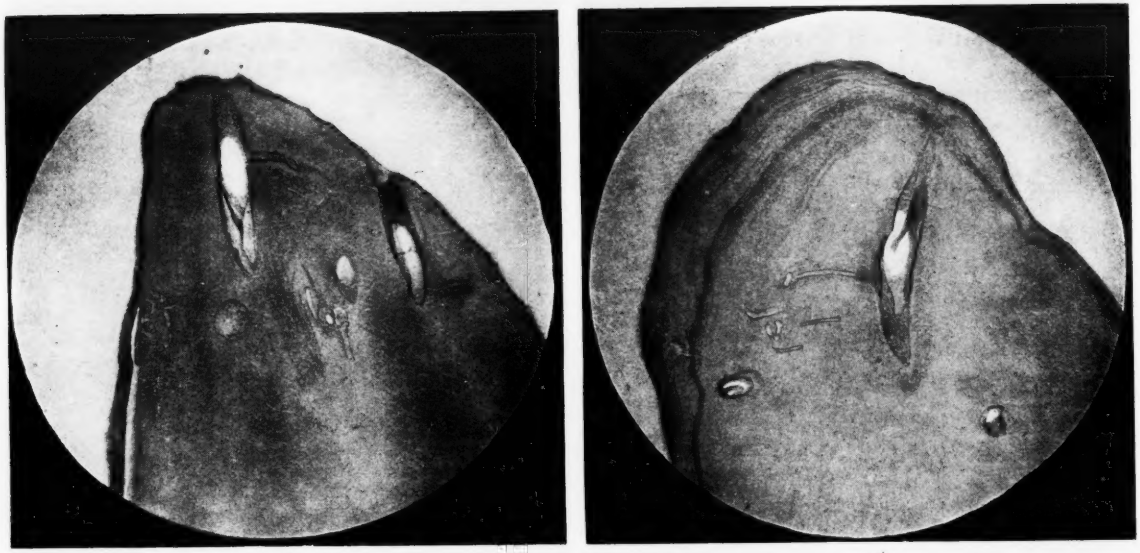


1 2

1, Longitudinal section thru the apical foramina of an upper second bicuspid. Arborescent network of pulp canals in apex. Patient thirty-five years old.

2, Longitudinal section thru the apex of an upper first bicuspid. Patient forty-one years old. Ramification of root-canals in apical region. Complicated dentin structure.

Plate b



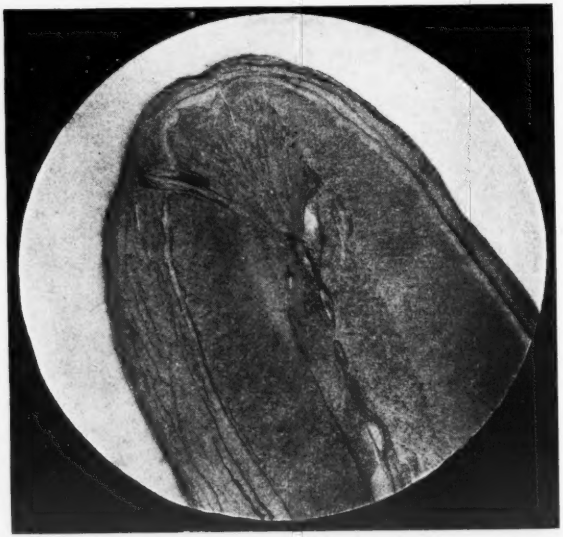
3 4

3, Longitudinal section thru the apex of a lower second bicuspid. Patient thirty years old. Some of the fine apical ramifications are cut longitudinally and some transversely. From the pulp canal some fine tubules extend into the dentin.

4, Longitudinal section thru the mesial root of a lower first molar. Patient twenty-eight years old. Some of the fine apical canals are cut longitudinally and some cut transversely. Slender anastomosing branches connect the individual canals.

Plate c

5

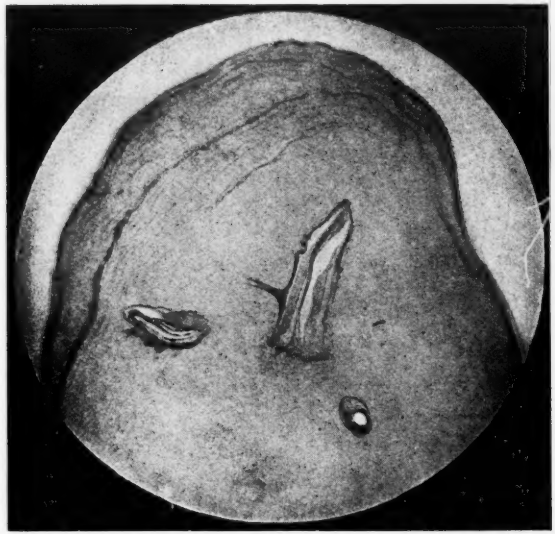


6

5, Longitudinal section thru apex of a lower cuspid. Patient thirty-two years old. The root-canal branches out into fine apical ramifications.

6, Longitudinal section thru apex of an upper central incisor. Patient fifty-one years old. The root-canal is partly obliterated but still shows some slender branchings in the apical region.

Plate d



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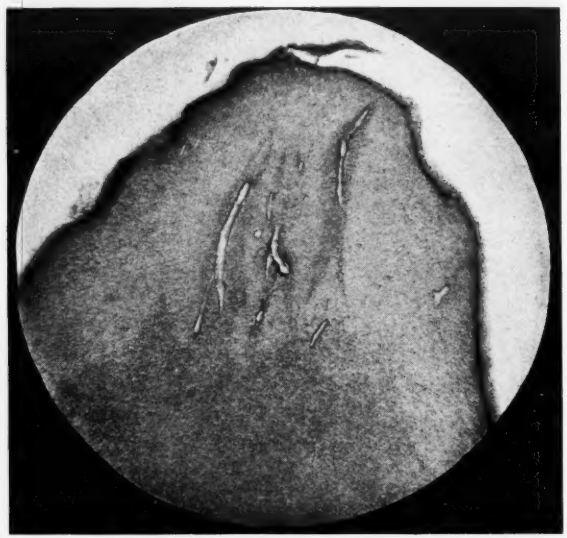


8

7, Longitudinal section thru the distal root of a lower second molar. Patient twenty-one years old. The ramifications of the root-canal are cut transversely. Slender marrow canals extend from the root-canal into the root dentin.

8, Longitudinal section thru the apex of an upper third molar. Patient forty years old. The whole apex is penetrated by a fine network of canaliculi.

Plate e

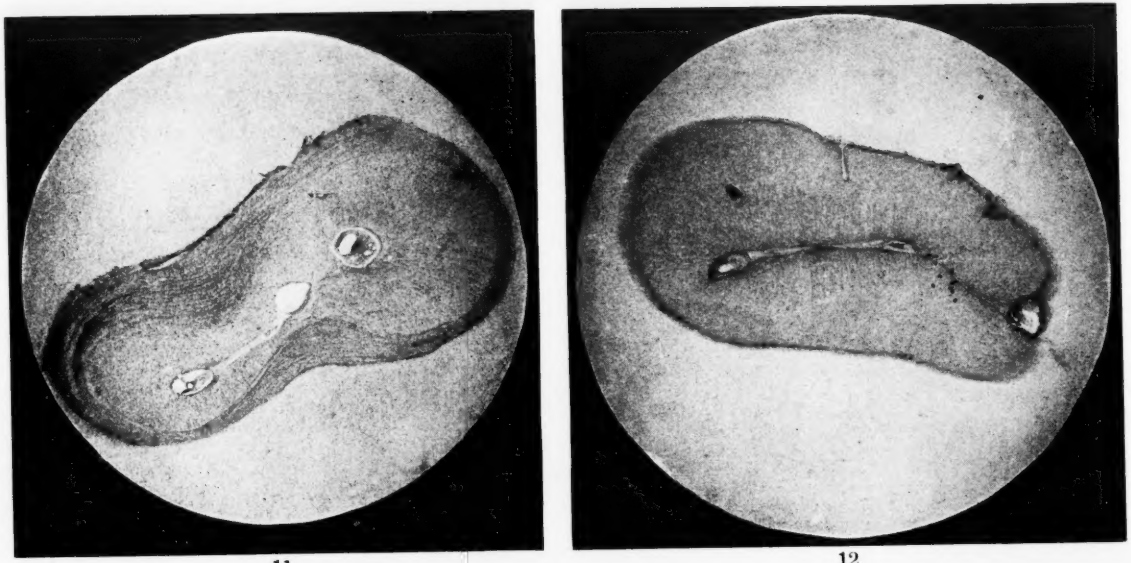
9

10

9, Longitudinal section thru mesial buccal apex of an upper second molar. Patient thirty-five years old. The apical region shows a finely extended net-work of canals which look like perforations in the apex.

10, Longitudinal section thru apex of an upper lateral incisor. Patient thirty-one years old. The apex shows fine ramifications. Some lateral indications show tubules running to the periosteum (peridental membrane).

Plate f

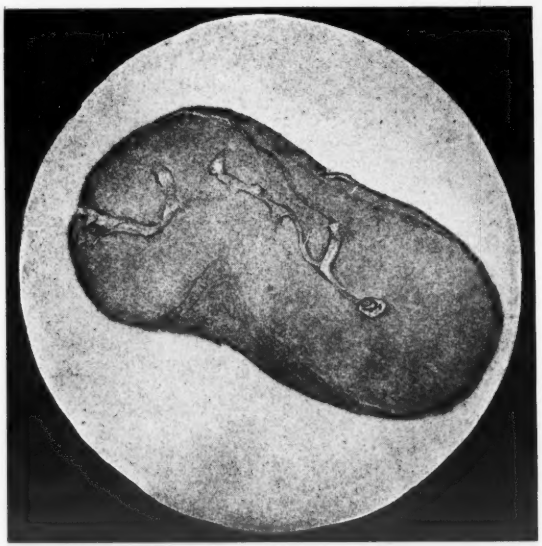


11 12

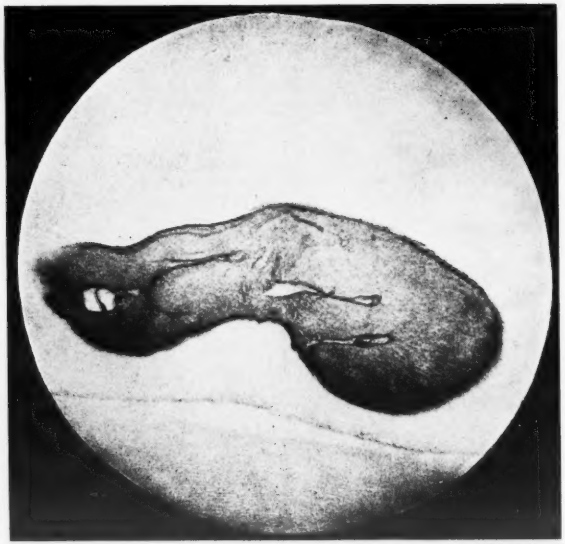
11, Cross-section thru apex of an upper first bicuspid. Patient twenty-five years old. Besides the two root-canals, there appears a third one in the center, which is connected with the buccal canal. Some slender tubules in cross-section are also seen.

12, Cross-section thru the apex of a lower second bicuspid. Patient sixteen years old. The lingual and buccal root-canals are connected thru cross-branches with a median canal.

Plate g



13

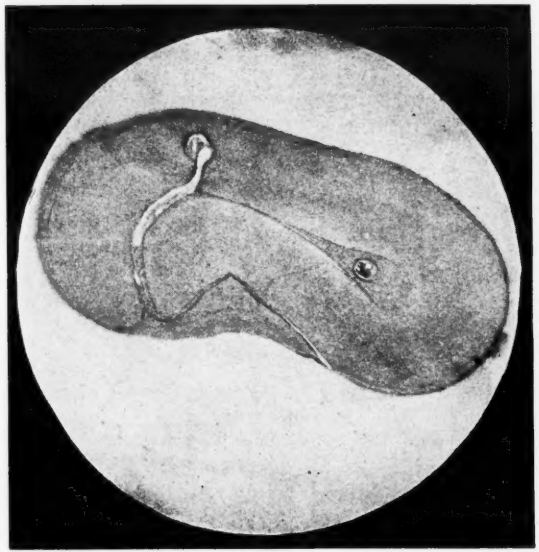


14

13, Cross-section thru apex of the mesial root of a lower second molar. Patient forty years old. Slender network with tubules.

14, Cross-section thru the apex of the mesio-buccal root of an upper first molar. Patient thirty-one years old. Numerous slender canals traverse the apical region.

Plate h



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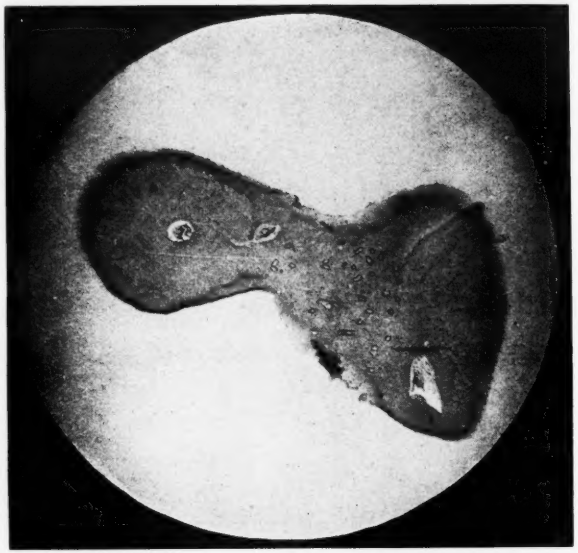
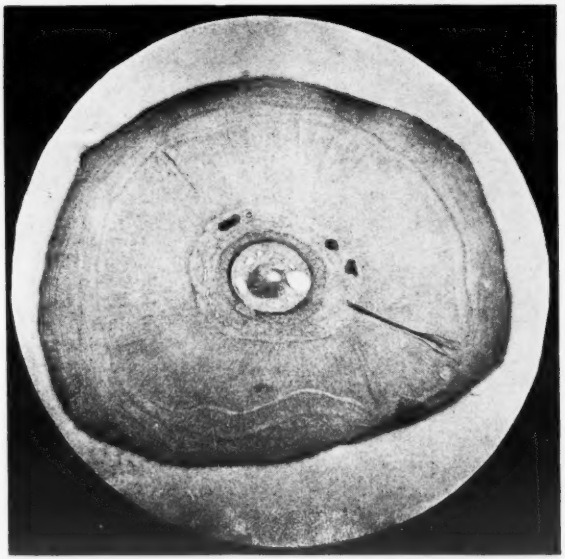


16

15, Cross-section thru apex of a lower cuspid. Patient thirty-five years old. Besides the two root-canals there is a side-branch which is connected with periosteum (peridental membrane).

16, Cross-section thru the apex of an upper third molar. Patient forty-five years old. Besides the apical branchings there are to be seen numerous slender cribiform canaliculi.

Plate i



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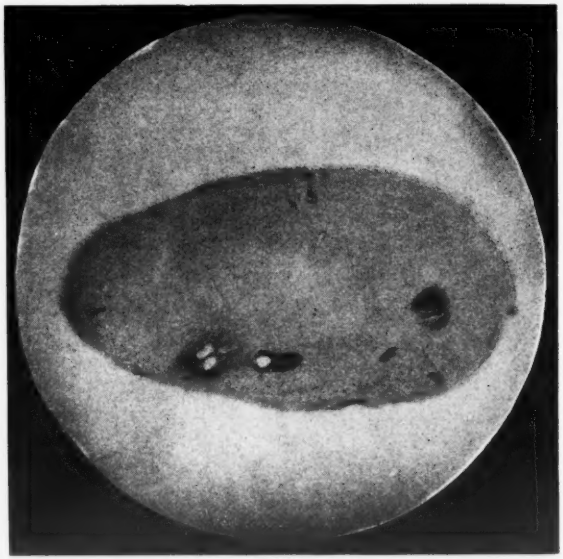
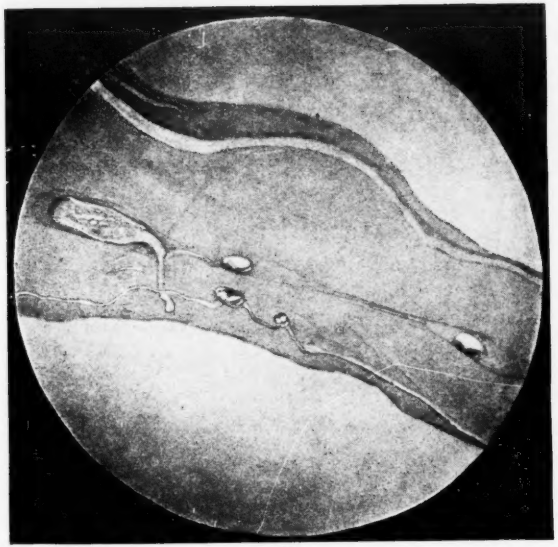


18

17, Cross-section thru the root of an upper central incisor in the upper third of the root. Patient twenty-four years old. A tubule is seen to extend from central (root) canal to the periosteum (peridental membrane).

18, Cross-section thru the apex of the distal root of a lower first molar. Patient thirty-eight years old. Several apical branches are seen in transverse section.

Plate k



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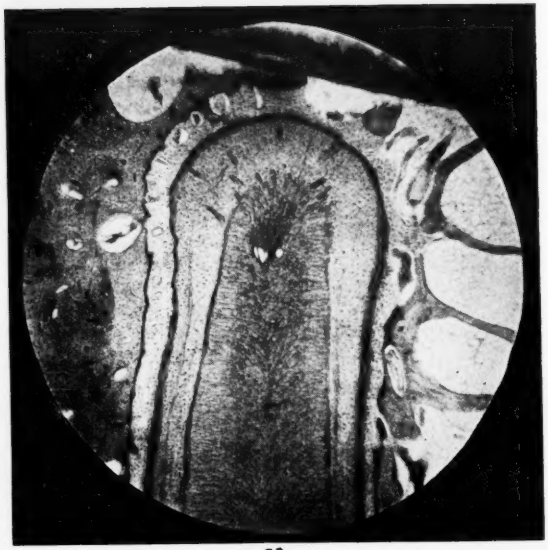

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19, Cross-section thru the fusion point of two roots of an upper second molar. Patient thirty years old. Numerous tubules traverse the root dentin.

20, Longitudinal section thru the tooth of a rabbit showing the bushy appearance of the apical branchings of the root-canal.

CAST ALUMINUM DENTURE BASES

By A. KLAFFENBACH, D.D.S., Iowa City, Iowa

IT IS needless to enter into a lengthy discussion on the metallurgy of aluminum as almost all are familiar with this silvery-white metal which is malleable, ductile, tasteless, and odorless, with a specific gravity of about 1:75.

Because of its high thermal conductivity the thermal changes are conveyed to the mucous membrane of the mouth more readily, causing ice cream, hot or cold foods, tea, coffee, etc., to be truly enjoyed and relished by the wearer of a base made from this metal. The patient who has worn a vulcanite and changed to an aluminum denture is pleased with the feeling of cleanliness and the more nearly normal sensation it imparts. Since the aluminum does not cause the tissues to become heated, as does a vulcanite base, certain pathological changes are prevented.

Aluminum is electro-positive to all metals used in the mouth and as it forms a voltaic couple with other metals it necessitates caution, especially when used for partial dentures.

For casting it is absolutely essential that the purest aluminum obtainable be used, thereby lengthening the life of the base. The swaged aluminum denture base requires the making of a die and counter-die which takes considerable time and has the disadvantage of contaminating the aluminum with lead and zinc, thus causing it to deteriorate in the mouth. It is also difficult to obtain sufficient retention for the vulcanite. In making the cast base we have the advantage of forming the base in wax and adding to or making adequate retention by means of various forms of spurs, rims, and lugs and then investing and casting, thus eliminating the making of a die and counter die.

The greatest difficulty to be overcome, however, in a casting of this size is warpage, caused by changes in the investment compound and the contraction of the aluminum while solidifying. After making a number of bases, using various inlay and crown and bridge investments, investing them differently, and using different casting methods, the fact that these two things had taken place, resulting in distortion, was apparent and seemingly impossible to overcome. Because of this distortion it is necessary to swage the base after being cast, but on account of it being very nearly adapted it does not require a die and counter-die to do this, but instead the cast is used to swage over, as will be explained later.

The first requisite toward making an aluminum base is, of course, a good impression from which a cast of Spence compound is obtained. The base of the cast is made much heavier than for an ordinary cast so that it can withstand the strain of swaging. As the indirect method is used in most cases only one cast is required. Where the undercuts are excessive it is best to obtain another make of crown and bridge investment by taking an impression of the Spence cast and casting by the direct method. If reliefs are necessary the impression may be scraped or a thick tin foil or adhesive tape cut to the required size and shape and pasted on the Spence cast, after which it is made smooth by applying talcum or soapstone.

Tenax, or any thin, light-colored, translucent wax should be used for the

pattern. Dirty or highly colored wax should not be used for this purpose as it is sure to have a residue and cause holes or other imperfections in the casting. The sheet of wax is adapted, cut and trimmed to proper shape and size. For retention of vulcanite a strip of wax about one-eighth of an inch in width is cut the long way of the sheet by laying a bevel-edged ruler on it and holding the knife at a slant while cutting, thus producing a strip with one slanting edge. This strip, with the beveled-edge against the wax base, is placed just to undercut with a large inverted cone bur. If more retention is required lugs may be made of wax and placed at suitable places so as not to interfere with the placing of the teeth.

When the wax pattern is to be invested on end a strip of wax about one-fourth of an inch in width is fastened at the heel on each side and one extending from, or slightly to, the lingual of the crest of the ridge near the median line—the three strips extending posteriorly terminating in a single sprue about three-sixteenths of an inch in diameter.

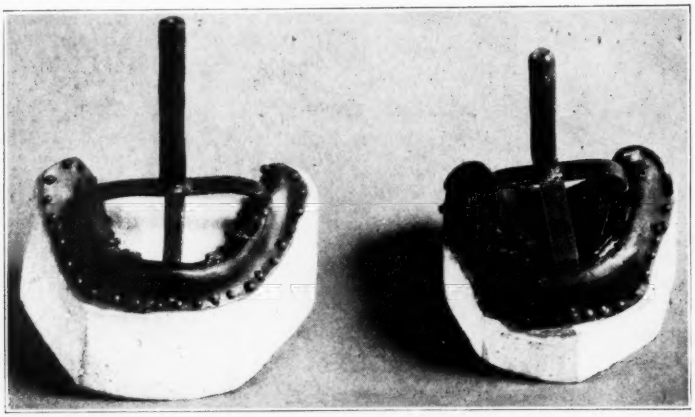

Fig. 1 Fig. 2

Lower (Fig. 1) and upper (Fig. 2) wax patterns ready to be removed for investment. Note thickness of Spence cast.

the lingual of where the teeth will extend and projected from the heel over the tuberosity and around the palatal portion to the other side, forming a V-shaped space and a rim, which is securely and smoothly fastened with a hot spatula. The wax strip is not extended around the bucco-labial edge because of the thickness, which would interfere with swaging. Instead a narrow strip of wax is heated on the end and the wax allowed to drop near the peripheral border producing little beads which when cast can be flattened with a stone and

When invested flat one of the strips extends slightly lingual from the crest of the ridge on one side to a similar position on the other side in the posterior third of the arch; the other extending from the crest of the ridge, near the median line, posteriorly to the other strip. A roll about three-sixteenths of an inch in diameter is fastened at right angles at the junction of these two strips. On the cast base the strips are cut off within one-sixteenth of an inch; the remaining portion is then shaped and serves as a retentive lug. For full bases

either way may be followed but for partials requiring a great many lead sprues the end investment is the best, for by investing this way they are done away with.

Crown and bridge investment, thoroly mixed, is used for investing. The wax pattern is carefully lifted from the cast, carefully cleansed, and painted. It is necessary that the investment reach under the rim and around the attachments. A portion is then poured into the ring and the wax pattern gently pressed into it, after which the ring is filled; the wax sprue should be long enough to extend above the top of the ring. When the investment compound has set a crucible is formed by scraping out the investment until one of desirable size has been made. Care must be taken not to make it too deep for if too much is removed

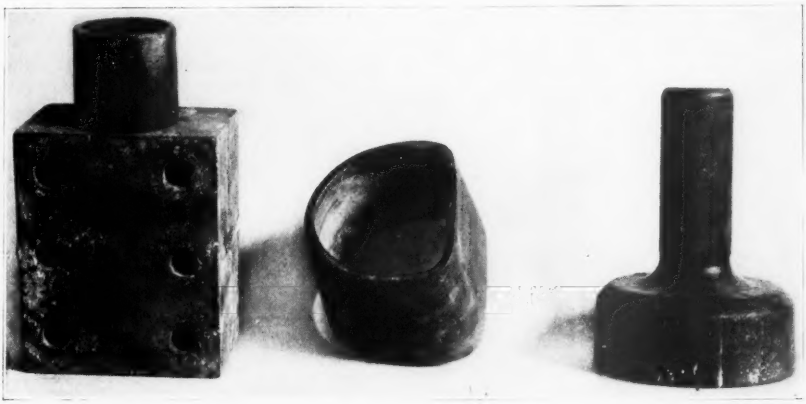

Fig. 4 Fig. 3 Fig. 5

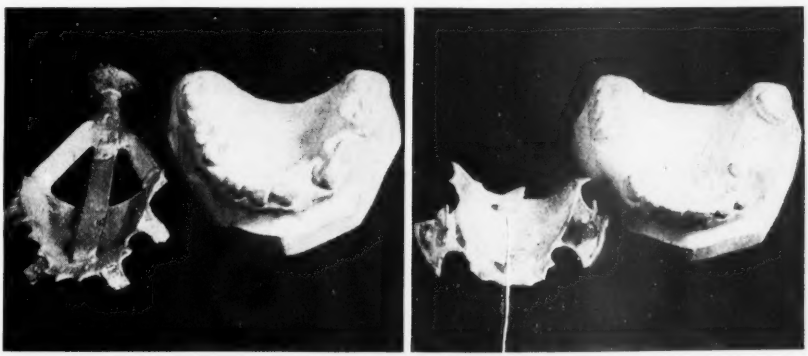

Fig. 6 Fig. 7

Figs. 6, 7.—Fig. 6, partial upper, showing arrangement of lead sprues for end investment. **Fig. 7**, partial upper, showing ends of lead sprues and arrangement of same.

only a thin layer of investment will remain over the top of the cast, which when pressure is applied is liable to break thru.

As soon as the investment has dried sufficiently, the wax may be removed by boiling it out carefully, or by heating slowly and allowing a portion of the wax to run out. When the investment has become hot (at least an hour being needed to heat it) it is ready to be cast.

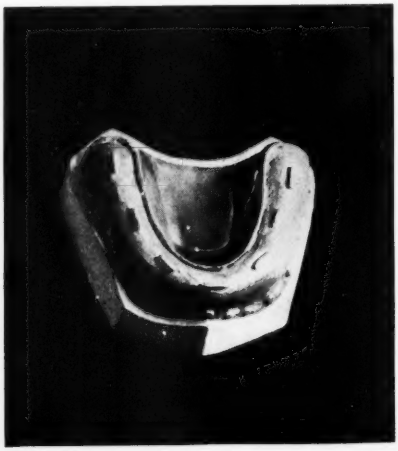

Fig. 8.—Completed cast aluminum denture base.

The ring used for flat investment (Fig. 3) is about 3¼ inches in diameter and 2½ inches high, and should be shaped to conform with the outline of the wax pattern, allowing for sufficient investment between it and the ring.

For end investment a box flask (Fig. 4), which opens thru the center lengthwise is used to facilitate investing. It is 3¼×4×2 inches in size, and thus allows for an equal distribution of investment compound around the wax pattern.

An asbestos moistened pad (Fig. 5) about 4½ inches in diameter and 2 inches deep is used for casting to produce the pressure necessary to force the molten aluminum into the mold.

Suitable rings and investments may be used so that the air pressure produced by a rubber bulb or centrifugal force may be employed to produce similar results.

The ingot of pure aluminum, about twice the amount required for the base, is placed in the crucible and heated until it becomes liquid, the thin oxide is then removed and the asbestos pad, or any other means of forcing the metal into the mold is applied.

Sufficient time should be taken for cooling, for if the aluminum cast and investment are chilled suddenly the result will be more distortion and more molecular change, which produce a poor and more distorted base.

When cold the investment is removed and the cast base cleansed. The lead sprues are cut off close to the casting and the remaining portion shaped into a retentive lug. The palatal surface should then be examined for bubbles and if any are found they should be removed at this time. The periphery is carefully adapted, using a pine wood stick and leather-tipped mallet.

The cast and base are then placed in a Parker swager, or one consisting of a steel tube with a metal plunger, and surrounded by Melotte's Moldine, or putty (the base having been covered with rubber dam). The plunger is struck a heavy blow, which drives the aluminum base against the Spence cast.

The aluminum cast denture base is then removed, the lugs and spurs ground to proper shape and if more retention is desired the surface from the rim to the periphery may be spurred by using the angle point of a chisel. The palatal portion between the rim is polished and it is then ready for the wax for the trial base.

ETIOLOGICAL RELATION OF FOCAL INFECTIONS TO REMOTE DISEASES

By THOMAS B. HARTZELL, M.D., D.M.D, Minneapolis, Minnesota

(Read before the Illinois State Dental Society, Peoria, Illinois, May 10-12, 1921)

THERE is a growing tendency in the dental profession to overlook the fact that there are other foci of infection than those of the mouth that produce diseases remote from the site and time of the original infection and whose effects are not unlike, in some of their symptoms at least, symptoms produced by foci of infection in the investing tissues of the teeth. These errors in diagnosis by the dentist produce exceedingly bad impressions in the mind of the intelligent physician and dire results for the patient. If conclusions deduced from such diagnosis be acted upon, they lead to the needless destruction of valuable teeth and possibly the very life of the patient is endangered or lost.

To illustrate my point I will relate a series of recent case histories. A patient was recently referred to me by a physician. She was a schoolteacher by profession and forty years of age. The physician's diagnosis was muscular and articular rheumatism. The condition of the patient to some extent justified this diagnosis in that the tissues over the joints were swollen and the muscles of the body sore. Her hands and feet and ankles were swollen. She was suffering pain in her back and had heart weakness. At the time she was first seen by me her temperature was 100.2°. The general color of her skin was yellowish green and there was present slight lachrhymation and conjunctival inflammation. The physician's advice was the extraction of all pulpless teeth. X-ray examination revealed a number of pulpless teeth, some of which, as X-ray findings would indicate, seemed to be perfectly normal in that the root-canals were well filled and the lamina dura of the socket outline perfect. Two or three of these pulpless teeth, however, indicated pathology. As I was not satisfied with the diagnosis, I promptly undertook a general examination and found that the patient's blood revealed eosinophilia of 38 per cent. Therefore the question arose in my mind as to whether we were dealing with an arthritis or with some condition simulating arthritis, for an eosinophilia of 38 per cent might well be due to trichinosis or to a great aggregation of intestinal parasites, as these are the two commonest things associated with a great increase in the eosinophile cells. An investigation of the intestinal flora proved it to be about normal. The question then arose as to whether or not this condition could be due to infection by *Trichina spiralis*. A careful investigation of the patient's personal and family history disclosed the fact that a sister, the only other member of the family, had many of the same symptoms, including a 34 per cent eosinophilia and that some

six weeks before they had partaken of pork steak cooked rare. Therefore, in the subsequent handling of this case, I removed only the teeth that showed evident pathology, and in the course of six months all of the symptoms of trichinosis slowly subsided. The patients today are both in good health. The symptoms of arthritis did not disappear rapidly on extraction of the teeth, but all symptoms including lachrymation, muscle soreness, and swelling slowly disappeared as the vitality of the individual overcame the trichinae. It may have been possible that there was an actual invasion of the tissues forming the capsules of the joint by streptococci. It may have been a combined infection, as frequently happens, but the point I wish to make here is that to have jumped at the conclusion that we were dealing with a streptococcal inflammation pure and simple arising from teeth alone would have been absolutely wrong in the presence of such a blood picture and the fact that the sister evinced the same general character of symptoms without the presence of diseased teeth indicates that the principal source of trouble in these two cases was trichinae, not rheumatism.

The following is another case in point. Some time ago, a patient was referred to me by a dentist for treatment. The patient was a woman of middle age and had been ill for a long time. She presented the general symptoms of streptococcal poisoning. She was physically weak, complaining of languor, lack of energy, and was tired and listless. She contended, however, that she was not ill but only tired. An examination of the mouth revealed a copious pyorrhea. Her teeth were loose, and most of them were candidates for immediate extraction. The low blood pressure and rapid pulse and general condition of weakness led me to decline operative interference for the time being. An examination of the blood justified that view in that her hemoglobin was 46 per cent; erythrocytes, two million; leucocytes, four thousand eight hundred. The percentage of polymorphonuclears was 44 per cent and lymphocytes, 51, with a large number of anisocytes, poikilocytes, macrocytes, and microcytes, which confirmed the diagnosis of pernicious anemia of the advanced type. While I have occasionally had a marked temporary improvement in the general blood picture as a result of the removal of diseased teeth, I never yet have seen a case of pernicious anemia permanently cured by this or any other method, and feeling that the condition of the patient was exceedingly precarious, nothing for the time being was undertaken except to advise rest, mouth sanitation, and a constructive diet. Death occurred in less than four weeks from the time this patient was examined by me. In view of the fact that this patient kept up until the very last, one would have been justified without investigation to attempt dental surgery and would have been justified in the general conclusion that the patient's condition was primarily due to mouth infection; further, the practitioner in charge might reasonably have promised great improvement as a result of the extraction of the teeth. Nevertheless, the facts in the case indicate that the patient would have certainly died.

At the present time, I have a patient in one of the Minneapolis hospitals who had been suffering from a severe pyorrhea, whose mouth contained two pulpless teeth about the root ends of which were good-sized granulomas. The doctor proceeded with active and rather efficient pyorrhea treatment and subjected the patient first to a local anesthetic for the removal of the teeth. Failing to get a good anesthesia, he followed

the local anesthetic with a general anesthetic and removed the infected teeth. As the patient continued poor in health, she was then referred to me for care and treatment. This patient suffered continuous pain in her jaw from December to March as a result of the removal of the granulomatous masses in the lower jaw and she has an acute exacerbation of all her symptoms, running a temperature for a short time of 103.5° to 104°. The history of this case reveals the fact that six years ago the patient experienced an acute tubercular infection, the tubercle bacilli having been found in the sputum. She spent a portion of these years in the mountain regions of the Southwest and regained her normal weight as a result of diet, rest, and outdoor treatment.

Immediately following the exhibition of the general anesthetic and pain in her jaw, she began to lose weight and has been losing weight ever since. After the gums had been cut away from her pyorrhea teeth and the granulomatous masses removed after extraction, the pulps of the two perfectly sound teeth remaining on that side of her jaw where she suffered pain became hypersensitive. In March, a cuspid and second bicuspid were removed by the use of local anesthetic since which time the patient has been free from pain in the facial area, altho there still obtains a condition of numbness from the initial operation performed last fall. It would perhaps have been far better if she had been taught proper mouth sanitation with the toothbrush only and the pathologic areas allowed to remain, or be operated upon at sufficiently long intervals to have produced only a ripple in the energy of the patient instead of producing active pain, invasion of pulps, loss of energy due to the suffering of pain, and the disturbance of an old tubercular fibrosis in the lung caused by the deep inbreathing of nitrous oxide. We all know that in the use of nitrous oxide we occasionally have patients who breathe abnormally deeply for a short while, thus tending to break down the limiting walls that nature builds around a tuberculous area.

I wish to deal with a different type of pathological lesion which produces arthritis, simulating in many ways arthritis caused by the streptococcus. I refer to the gonococcus. Sometime ago I visited a case in the hospital which exhibited the typical evidences of arthritis of the streptococcal type, swelling and involvement of some of the joints which gave history of slow onset and progress, while some other joints had become involved rather rapidly. Investigation of the mouth did show that there was and had been for some time a pyorrhea, and also evidences of granulomatous areas around the root ends of some pulpless teeth. A history of gonorrhea was also obtained. Investigation of the joint fluid showed the gonococcus to be present. To promise a patient of this type complete cure or even suggest it would only have led to disappointment. It was a condition of combined infection that required both the skill of the dentist and physician. When one reflects upon the extensive prevalence of gonorrhea and the possibility that many joint infections are due to the gonococcus, it is wrong to ascribe a major role to mouth infection. Finger (1) says that 2 per cent of all gonococcal infections become rheumatic.

Take another case related to me by the late Dr. Murphy of Chicago, a case of a general arthritis. Many a case was made to function due to his untiring efforts and skill. To illustrate his point in determining what one should observe in forming a correct diagnosis (and he was then talking to the Hennepin County Medical Society) he related

the case of a man who came under his care in Chicago who had a general arthritis, and a positive diagnosis of colon bacilli arthritis was made. The train of the infection had come from a wound as a result of striking a match, making a puncture wound on the thumb at the time of stool. The clinical history of this case was so perfect and complete that I am sure no one doubted the facts in the case as related by Dr. Murphy.

Then there is a condition of cholecystitis which begins ofttimes in childhood in which chronic infection of the gall bladder results in a series of symptoms often closely simulating symptoms produced by mouth infection and often mistaken for them. Indeed it might be possible that cholecystitis in many instances might be planted by trifling bacterial emboli entering the blood stream from the mouth, eventually finding their way into the gall bladder and becoming the nidus about which lime salts are subsequently deposited.

I once stood at the elbow of J. H. Dunn, one of the older surgeons in Minneapolis long since past to his reward. He was removing a gall stone from the gall bladder of a twelve-year-old child. I also remember watching this same surgeon remove a stone from the bladder of a young boy between twelve and fifteen years of age. The question is, Where do the inflammatory conditions arise which lead to the production of stones in urinary and gall bladders? If conditions arise thru the progress of either condition that would lead the dentist to the belief that focal infection of the jaws was the main etiological factor, would it not be a grave mistake to ascribe to focal infections in the jaws, remote conditions of this type unless the proof were very positive and direct, inasmuch as these troubles may have arisen from a coryza or an acute tonsilitis in childhood?

The following is a case of a tooth extraction followed by death. Mrs. C. was a young woman of previous good health and robust constitution. At the time first seen, she was suffering from lupus erythematosus on the face. X-ray examination of the patient's mouth showed the need for several abscessed teeth to be extracted. One group involving two teeth surrounded by a single large granuloma was removed and the granulomatous sack dissected. Within two days her face was swollen and eyes closed. Her skin presented an erythematous rash over arms, legs, and body. She was given a bed in the University Hospital and her condition became rapidly worse, the rash involving the whole body. The skin was red and swollen and weeping from all inflamed areas particularly the face, neck, and arms. In rapid succession the lungs became involved. Clinical findings showed rales, suggesting a miliary tuberculosis. No tubercle bacilli were found in her sputa or in blood culture. The skin condition was attended by high fever (105°) lasting for several days. As the skin slowly improved the fever returned to normal and the patient was permitted to sit up in bed for a half-hour. This effort was followed the next day by a temperature of 105° and continued for a week and was followed by death. This case was one of a series in which an attempt was made to study lupus erythematosus. Extracting teeth in cases of lupus erythematosus is a risky procedure on account of the fact that it not infrequently initiates a general miliary tuberculosis which may end in death. This case began as the discoid type as a result of tooth extraction. It is commonly called in our books lupus erythematosis disseminatus.

Then too, hypo-thyroidism obtains in a certain class of individuals who also have infection of the mouth and jaws. Thyroid disease, if we may believe the

research work done by McCarrison, (2) is distinctly a disease of infection and has been quite overlooked by the dental profession in the formulation of diagnoses of physical conditions alleged to arise from focal infection in the jaws. Any premise laid on the foundation of focal infection in the jaws alone in the presence of atrophy of a thyroid gland is quite likely to be wrong and comparatively valueless. I have in my own experience found cases of general infection which seemed to me dependent on infection of the mouth and jaws of both endocarditis and arthritis in which I have failed to bring about improved conditions as a result of eliminating infections of the jaws. Where all pulpless teeth, pyorrhea teeth, and diseased tonsils have been removed and still the condition of arthritis has continued to exist, I usually have the basal metabolic rate test made. I believe it is unquestionably true as shown by the work of many men on thyroid conditions that the metabolic rate of the body is controlled by the endocarine glands and particularly the thyroid and parathyroid. By the foregoing statements I mean to imply that the rate at which new material is built into the body and used material thrown out of the tissues of the body is controlled by the secretion of these glands, and, if the secretion of these glands be unreasonably low, the powers of construction and elimination are so limited that repair fails to occur even tho all primary focal infections are overcome.

I might mention incidentally that internal medicine has made great progress in determining what the activity of the thyroid is by the analysis of expired air. In this connection I have recently had an experience with one particular case in which the elimination of mouth and throat infections had been completed and in which an arthritis of the shoulders, which had been present for two years, had not been benefited. This case was briefly as follows:

Patient, Mr. K., was sent to the laboratory for the running of his basal metabolic rate. It was found that his basal metabolic rate was minus thirty. Acting on this instruction, the exhibition of Burroughs extract of thyroid gland was commenced. Two and one-half grains as a dose three times a day for five days were first prescribed. Evidence of saturation of thyroid material being produced, the dose was finally reduced to one-tenth grain three times a day. The patient recently reported complete absence of all arthritic symptoms in both shoulders and has continued the use of three-tenths of a grain of thyroid per day. It seems possible that here too might be a line of cases, namely, those in which previous thyroid infection or atrophy of the thyroid has occurred, in which the basal metabolic rate has been so interfered with that repair cannot occur without the normal supply of thyroid and in which promises of rapid repair as a result of the elimination of tooth infections will not be borne out.

In view of the many brilliant results that have been accomplished by the elimination of mouth infection, dentists have promised more cures than they have a right to, and as a result of such unwarranted promises, have in many instances failed. Following such failures they have striven by more drastic measures to produce the results aimed at. There have arisen in different parts of the country a group of radical operators who place patients with diseased teeth in hospitals, loosen the gum and periosteum of the outer plate of the alveolar process of both upper and lower jaws, strip it back, as recommended by Dr. Shearer (4) of Omaha, and chisel away the bone to and beyond the root ends of the

teeth, removing tissue and the lamina dura involving the site where the granulomatous tissue has developed, and cutting away the interproximal bone, thus taking away more bone than would be lost by physiological processes. This operation is performed to cure perhaps incurable cases. The operation is in itself a major one, and produces much shock and much pain to the patient. With thirty years' experience with the alveolar process, I have satisfied myself with the belief of Talbot that the alveolar process is a structure built up as the teeth erupt and removed in part by nature when the teeth are lost. Where a single bit more bone is removed by surgical methods than nature would eventually remove after the teeth have been taken out, we bring about a condition which has made a certain number of these patients thus operated upon unable to wear artificial teeth, condemning them for the rest of their lives to the edentulous state.

The wrong conclusions that certain of our enthusiastic mouth infection advocates have made from a study of the alveolar process—that every area of bone seen in the X-ray more dense in places than is commonly noted is the evidence of pathology in such bone—I believe to be distinctly wrong. If these ardent advocates of drastic surgery of the bony tissue of the jaws were to take one hundred cases of individuals who have worn plates for a number of years and at the same time have exhibited good health, and who never have had any surgery of the jaws beyond the removal of their teeth, they would find these individuals presenting varying areas of increased density in the alveolar process supporting the plates which occur as a result of the stimulation caused by the weight of the artificial dentures during the act of mastication. These areas of increased density are nature's compensatory device to enable the individual to continue the act of mastication and are not to be considered as pathologic. Nature herself has taken care of the deep infections of the jaws for literally thousands of individuals who have not enjoyed the service of the modern dentist; it is idle to suppose that nature will not continue to render such beneficial aid to those who have suffered infection of the jaws in the future as she has in the past.

Reflect also on the fact that medicine agrees that about 90 per cent of our sick can and do recover, if permitted to rest, by the aid of their own vital powers. While the large operation will enable the operator to win a greater fee than the dentist who extracts diseased teeth and aids nature only by dissecting out granulomas when they do present, and who maintains an open gate for lymph drainage by the use of small lightly placed "tents" in the sockets, the major operation is not so beneficial to the patient. These "tents" are maintained in the sockets for a sufficient length of time to permit a continued outpour of lymph and lymphocytes from the circulation into the socket, such outpour eliminating from the bone the remaining infection which the leucocytes have not already destroyed. By treating a socket in this manner the more conservative man is doing vastly greater service to his patient than by the Shearer (4) or Novitsky (3) operation.

We have today in the dental profession a group of oral surgeons of whom we may be proud and I am glad to say they do not all agree that this large drastic operation is necessary. In my own experience, twenty-five years ago, I resected the bone of jaws of three or four such cases in this large way. Of course, it is foolish to generalize from a few experiences but I should advise those who

are studying this problem of infections remote from the site of the focus to carefully review their own experiences and draw their own conclusions from the evidence rather than from impulses of a few overenthusiastic men or from the story of any particular operator.

More than any one thing that the dental profession needs is to inform itself of the major diseases that operate in the body and not attempt to give dental service to people until it actually knows what the physical diagnosis is, thereby obviating the criticism that is voiced by the intelligent internists of the country that dentistry has gone mad on the question of focal infection.

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Discussion

Damon A. Brown, Peoria, Illinois: To me the most pleasing and inspiring thing about Dr. Hartzell's paper is the true note of conservatism and thoroness in dealing with the problem of oral focal infections and their relation to remote diseases.

With the advent and development of the X-ray as a diagnostic acquisition, certain hitherto unrecognized mouth conditions were revealed. The interpretation of the alveolar areas of rarefaction and thickening, as shown on the plate and film, into terms of pathology, and the relation of this pathology to local and remote disease has been one of the most important problems of the allied dental and medical professions during the past ten years. Unfortunately for all concerned, the enthusiasm that accompanies a new diagnostic or therapeutic measure is coupled with a large degree of ignorance in a large share of the professional body, and the result in the problem under discussion has been a holocaust of tooth extracting without obtaining, in far too many instances, the hoped for beneficial results. The tendency has been to jump at conclusions.

That oral sepsis is an etiological factor in many diseases of the body has been put upon too firm a foundation by experimental research, clinical observation, and therapeutic results to be any longer a question. To determine, however, in each individual case, whether or not, our patient's condition is due to a mouth infection requires the concentrated and co-operative efforts of both the dentist and the medical man. It is no less an error for the medical man to advise the extraction of his patient's teeth for the alleviation of symptoms, without first taking into consideration and eliminating every other possible cause of the diseased condition, than it is for the dentist who practices extraction to do so without as complete knowledge of the individual as it is possible for him to obtain. A therapeutic procedure as serious as the extraction of teeth should never be undertaken as a corrective measure for obscure disease without a complete history of the case, a thoro physical examination, laboratory examination of urine and blood, including the Wasserman, X-ray or any other special examination, such as cystoscopy, where indicated, and, as Dr. Hartzell mentioned, the basal metabolic rate in every case where there is a question as to thyroid disfunction. Such a routine procedure will, without doubt, save teeth for many a patient that would otherwise be needlessly sacrificed, and put the removal of diseased teeth as foci of infection upon a much more rational basis.

As the real advance along dental and medical lines is one of prophylaxis, it occurs to me that the work of the orthodontist does not occupy as important a place in as large a field as it might. School children in most public schools are now taught the value of personal hygiene—that a clean tooth is not apt to decay. But there are many cases of malformed teeth and jaws which, if allowed to go untreated, will assuredly result in conditions impairing the individual's health in his later years. This truly is a wonderful field for the practice of preventive medicine.

Co-operation and group practice is occupying the minds of many men at the present time to an extent never before thought of; of the several branches of the profession practicing the healing art, there is nowhere greater need for conscientious, conservative co-operation than between the dental and medical men.

P. G. Puterbaugh, Chicago, Illinois: The question of responsibility for diagnosis in cases pointing to infection of the metastatic type is a vital one, and the great problem, from the dental standpoint, is just who is to assume that responsibility. I am certain that

it is not the desire of the dentist to undertake, unaided, the management of the type of cases outlined by Dr. Hartzell.

It would seem that the best results may be attained in the manner that Dr. Brown has just outlined, viz., the group clinic plan, where competent internists are available to carefully examine all patients who appear to be poorly nourished and in bad physical condition, before resorting to radical operative procedure for the removal of oral infections.

It is true that many cases of malaise, general indisposition, muscular weakness, arthritis, neuritis, etc., may be benefited by the elimination of peridental infections; it is likewise true that many patients do not receive benefit by that treatment who may show marked improvement under proper medical care.

We have reached the point where it would seem to be wise to secure the co-operation of competent medical men in most instances of disease pointing toward mouth infections, and to allow them to assume a part of the responsibility of the diagnosis and prognosis. Then we may rightfully undertake the elimination of infection from our field.

I am in hearty accord with the essayist in advising against the indiscriminate chiseling away of bone in order to eliminate small infected foci about the root ends. As a general rule good surgery demands thoro drainage of abscesses, not their excision. Drainage must be maintained until the deep portion fills in by granulation.

Bone as a tissue is one of the most susceptible to infections and is at the same time one of the best disseminators of infection. It is therefore quite natural to expect severe systemic reactions from relatively small foci about the apices of teeth.

Dr. Hartzell (closing): There is not a single word in this paper which would indicate that I have in any way receded from the position I have occupied in regard to focal infection for the last five or six years. I am not taking back any previous statements made in regard to the importance of focal infection in the production of disease. I am unquestionably of the opinion that an infinite amount of good has been done by the recognition of the fact that infection arising in the mouth may be a source of metastatic infection in other parts of the body, is worth everything it has cost the dental profession and is deserving of all the credence that has been given it. However, I am equally sure that the old logic is distinctly untrue, and I gave this recitation of case histories to bring those of you who have attached too much importance to the question of focal infection a glimpse of the other side of the question. Last year in different states in this Union, in the hands of competent men, there have been ten deaths due to the drastic removal of teeth—unnecessary deaths—because a perfect diagnostic foundation had not been laid before the work was undertaken. We have this knowledge. What we need is to co-operate with our medical brothers, where we have not a medical training ourselves, and gather all the information that is possible about the case before we make up our minds what to do. When we have gathered that information, we must have courage to stand by our own opinion.

A HOME-MADE FURNACE FOR INLAYS AND SMALL SADDLE CASES

By W. D. RUSH, D.D.S., Cleveland, Oklahoma

A SIMPLE and accurate furnace for drying out inlay cases may be constructed by anyone, and most of the material is available in the laboratory. This furnace will meet the requirements for a low even heat, maintained for any length of time under perfect control, and it seems to be the opinion of most authorities on cast inlay work that this heat should be well under 400° F.

All that is required to construct this furnace is a tin receptacle and an extra lid for same, such as Weinstein's investments are packed in, a 75-watt lamp, a vulcanizer thermometer, a Dimalite socket and some asbestos wool.

A hole is cut a little below the center in one side of the can about one inch in diameter. The globe is introduced thru large opening at the top of can, and the socket end of the globe is put thru the hole in the side. Asbestos wool is then packed firmly around the globe, with about a half-inch thickness underneath the lamp. The packing should be level with the top of the lamp.

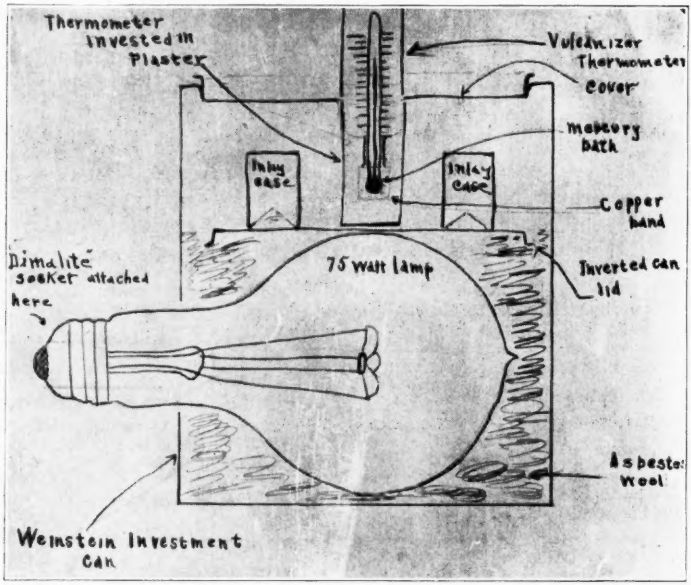
The extra lid is bent slightly so that it will pass thru the opening edgewise; then the lid is placed in a horizontal position, inverted, and made to rest on the asbestos packing. The lid serves as a floor, leaving room above it for cases.

For registering heat a vulcanizer thermometer is used, the main object being to get it under conditions approximating that of the wax pattern in the inlay mold. This may be done by investing the bulb of thermometer, which has been waxed in the small copper band containing the mercury bath, in ring about the size used for inlays which allows the bulb to be about the same distance from floor as the wax pattern usually is. The upper portion of tube and scale is thrust thru slot in the cover of can fastened to the lid with fine wires before the investment sets.

A resistance socket, such as is used for dimming an electric light is attached to the globe, which in turn is attached to the lamp cord. To heat up the furnace, the dimming attachment is eliminated entirely and the furnace allowed to heat up on "high." When 360°, or any desired temperature under 400° is reached the resistance is cut in a notch or two, and any desired graduation may be had, holding it stationary or reducing, as one may wish.

Advantages claimed are positive con-

trol, up to maximum generated by bulb, ease of construction, low cost, and ease of operating. The case may be left while operator goes to lunch without danger to cases invested or of danger from fire.



ANATOMY AS APPLIED TO ORAL SURGERY AND BLOCK ANESTHESIA

By ARTHUR E. SMITH, D.D.S., M.D., Chicago, Illinois

(Read before the American Society of Exodontists, Boston, Massachusetts, August 20, 21, 1920)

EVERY specialty in the professions of medicine and dentistry has for its foundation a thoro knowledge of that broad subject, anatomy. Anatomy and chemistry are the two subjects a thoro understanding of which is necessary before the student can master the other subjects, which have anatomy as their foundation. Anatomy is divided, first, into microscopic and macroscopic, and, second, into several branches, namely, embryology, histology, biology, and gross anatomy.

A surgeon, physician, or dentist cannot practice good surgery, medicine, or dentistry without a knowledge of anatomy and chemistry any more than an individual can maintain good health without proper nourishment, fresh air, and exercise. They are the fundamental sciences.

Thoro training of the dental student in embryology, histology, pathology and gross anatomy is highly essential, and in many instances training in these branches has been overlooked or grossly neglected, but the student cannot be blamed entirely for the reason that some dental colleges have not given a complete course in these important subjects. It is a well-known fact that during the past the consensus of opinion among dental students was that they did not need to be familiar with embryology, histology, zoology, biology and gross anatomy. This erroneous idea still seems to lurk in the minds of some dental students.

The practitioner who has not obtained training in these fundamental sciences realizes today his sad mistake. He not only finds himself greatly handicapped in his private practice, but it is also utterly impossible for him to enter the great field of experimental research.

All professional research has for its foundation either anatomy or chemistry. It would not have been possible to know what we do today about the ravages and results of focal infection were it not for the knowledge we have of histology and pathology, both of which are based upon anatomy. It would not be possible to practice oral surgery and block anesthesia without a thoro familiarity of the anatomic parts. Surely an impacted third molar should not be removed or a radical operation for empyema of the antrum performed or a deep block injection made by an operator who was in doubt as to the anatomy. Gross anatomy teaches us the dependence and interdependence of parts, their location and relationship to one another, but an intelligent understanding of gross anatomy cannot be obtained without first knowing

the primary subjects, embryology, histology and biology. It is indeed gratifying to note the advancement which has been made within recent years in many colleges in presenting these important branches in a more complete manner.

It matters not whether you are practicing oral surgery, orthodontia, prosthetic or operative dentistry, prophylaxis, pyorrhea, or the interpretation of the dental radiograph, a knowledge of anatomy is essential. Many errors in diagnosis have been made from a lack of knowledge of anatomy, not only in oral surgery, but in the interpretation of the radiograph. To be an efficient diagnostician and operator one needs to know the principles of anatomy. Many a misinterpretation of the radiograph has been caused by a lack of familiarity with the coronoid process, zygomatic arch, malar bone, mental foramen, inferior dental canal, antrum, unerupted or impacted teeth and varying densities of process and bone. The tissues of many patients have been ruthlessly mutilated in oral surgery and many block injections have been failures, because of the ignorance of technic and improper diagnosis.

The internal maxillary artery is seldom involved in oral operations, but its various branches are implicated to a considerable extent. These branches are highly important to the oral surgeon, inasmuch as they supply the operative field many times.

The inferior dental artery gives rise to considerable hemorrhage when the lower jaw is operated for such operations as fractures, alveolotomy, and the extraction of badly impacted lower third molars.

The deep temporal branch is involved and may give troublesome hemorrhage, unless ligated during the removal of the Gasserian ganglion on the severance of the sensory root of the fifth nerve for the treatment of tic douloureux. The infraorbital artery is also highly important to the oral surgeon for it is involved in operations upon the infraorbital nerve. The descending palatine artery passes downward and thru the posterior palatine canal with the anterior palatine nerve from Meckel's ganglion, emerging upon the hard palate thru the posterior palatine foramen. When operating for cleft palate this artery and its branches cause hemorrhages and in many instances ligation is very helpful.

The upper portion of the pharynx is supplied by the pterygo-palatine and Vidian branches which cause hemorrhage following the removal of adenoids. The spheno and descending palatine arteries supply the superior part of the tonsil and in many instances their severance results in serious hemorrhage following tonsillectomy. These small vessels give rise to considerable hemorrhage while operating on Meckel's ganglion. The nasopalatine artery passes downward and forward along the nasal septum and an operation upon the tissues forming the nasal septum may cause profuse hemorrhage, unless checked.

The posterior superior alveolar artery enters the posterior superior alveolar foramen (with the nerve of the same name) and supplies the alveolar process, major portion of the antrum, buccal muco-periosteum, molars and bicuspid teeth in the upper jaw, and considerable hemorrhage follows an operation upon these tissues via this artery. During the resection of the upper jaw, hemorrhage will occur from a number of the branches of the internal maxillary artery. For a major operation involving the tissues in the region of the internal maxillary artery, it is good practice to ligate the internal carotid, which assists the operator to an immeasurable extent in checking hemorrhage.

When blocking the second division of the fifth nerve by the intraoral method or the blocking of the superior posterior alveolar nerve employing the correct technic, the needle does not come near the internal maxillary artery.

The nervus trigeminus and its connecting branches with other nerves is indeed difficult anatomy to master and understand. The location of this nerve with its extreme nerve complexity requires considerable study. No doubt you will agree with me that while you were a student in college that more time was spent on this part of anatomy than on any other part of the human body, and we realized our inability to discuss intelligently this nerve and all of its connecting links on examination day.

I realize that many dentists need to review this important subject before they attempt the practice of oral surgery, or make the deep block anesthesia injections. It would be wholly unwarranted and unjustified for any practitioner to subject his patient to deep block anesthesia injections if he is not acquainted with the nerve branches and their location.

The inserting of needles promiscuously into the tissues or the undertaking of a major oral operation if the anatomy involved is not understood is certainly bad practice. It is quite true that little knowledge of anatomy is necessary for making submucous injections, but for deep nerve-blocking injections, such as the blocking of the first, second and third divisions of the fifth nerve and their important branches, and the various branches from the cervical plexus and cervical ganglia, it is imperative that the operator must have his knowledge of anatomy at his finger tips in order to execute his work in an efficient manner. The successful oral surgeon has a clear mental picture of the anatomical parts involved and can easily outline them on paper or on the blackboard.

TESTIMONIAL BANQUET TENDERED CHARLES NELSON JOHNSON, M.A., L.D.S., D.D.S.

(By the dental profession of Chicago and his former students, in celebration of his completion of forty years of professional service, Monday evening, April 11, 1921, at seven o'clock, Hotel La Salle, Chicago, Illinois.)

P. G. Puterbaugh, Chairman of the Banquet Committee.

It is indeed a pleasure and a gratification to the committee in charge of this banquet to know that the responses have been so numerous and so generous in every way, indeed it has not been a big task to bring this dinner to a successful climax. It has been a simple task because we had a great cause for it. The toasts this evening are to a man who has practiced in our midst for forty years, a man who has made a world record as a writer, teacher, author and scholar, and as a man who knows human hearts and human kindness.

It gives me great pleasure to announce that Dr. William H. G. Logan, dean of the Chicago College of Dental Surgery will act as toastmaster.[1]

The Toastmaster: It is indeed a pleasure to welcome you all. The first speaker comes from a city filled with smoke enough to cloud his eyes, but it has not done so. He is a forward-looking man, one who not only has a vision but lives up to it in every sense of the word. Dr. Friesell comes to us not only as the dean of the Dental Department of the Pittsburgh University, but also as president of the National Dental Association.

Dental Education and the Need of Trained Dental Teachers

By Henry E. Friesell, Pittsburgh, Pennsylvania

You are perhaps wondering why a toast like "Dental Education and the Need of Trained Dental Teachers" is to be responded to in your presence, but the fact that Dr. Johnson himself, the honored guest of this meeting, is one of the foremost dental teachers in the history of dentistry is sufficient reason for injecting this subject into the program.

Dental education occasionally comes to the surface as a subject of interest in the dental profession. Most of us, however, think very little of it after we receive our diplomas and say good-bye, for the time being, to alma mater, but dental education is the foundation of the dental profession. Dentistry became a profession when the science of dentistry and the art of dentistry were correlated in a curriculum and schools were established for the uniform instruction of men and women who took up the study and the practice of dentistry. Dentistry today is going thru some very interesting periods in its evolution and some very important and serious ones, ones that mean the future of dentistry as well as of dental education. I am going to refer only briefly to a few of these things.

Most of us feel that dental education began in this country in 1839 at the old

[1]Dr. Donald M. Gallie, who was to have acted as toastmaster, was unable to be present on account of the death of his brother.

Baltimore College of Dental Surgery, which was the first dental college established in the world, but the first dental school in this country was established long before that, about 1778 or 1779 in Middletown, Rhode Island, because it was there that Dr. LaMaire and Dr. Gardiet came with the French army under Rochambeau and taught dentistry to the first Americans, Flagg, Coverdale and others.

We dentists should be proud of the fact that American dentistry has developed as an independent profession because that development is really what makes American dentistry stand out as the dentistry to which the whole world looks up, and it is dental education and the fact that dental schools started out as independent dental colleges in 1839 that American dentistry and the dentistry of the world is where it is today.

In 1908 we had fifty-seven dental schools in this country; in 1921 we have forty-five. In 1839 the dental course was a two-year course of five months each. You could get credit for one year if you had been in somebody's office for two or three years practicing, or if you had started out to practice in your own office. I know one gentleman who received credit for one year for his school work and for having practiced for two or three years in some one else's office; he went to school the first week in the term and then came back the week before commencement and he got his diploma, and he was a dentist. (Laughter).

From 1839 to 1892 the course evolved rather slowly. In 1892 dental education took a spurt and the dental course was extended to three years, eventually to three years and six months, and then three years of seven months. A year or two later, in 1902, a four-year course was started, but it only lasted one year, and then, because it was premature, we dropped back to the three-year course, but extended the time to eight months and then to practically nine months. In 1917, a little less than four years ago, we actually began our four-year course on dental education, four years of nine months, forty-eight hundred hours of graded work in every subject that is necessary to produce a well-rounded, well-educated professional man in the field of dentistry.

There is today a tendency among a few in the profession to think that we should go faster and farther in the preparations we are making with young men and women to practice dentistry, and we hear very much of the pre-dental year. When you speak to an audience generally and you say we are going to add a year or two more education to this, that, or the other thing, it is natural for us, for everyone to feel that that is a good thing, that you can't get too much education, but there is another question, another factor to be considered, and that is the practical phase of the whole situation. If two years of college education is good for a dentist, if that is the only factor that you are to take into consideration, why not give him fifty years?

In 1908 we had something like 38,500 dentists in this country, last year we had 44,000, and that is a liberal estimate. In the twelve years, between 1908 and 1919, we graduated in all the schools of this country over 25,000 dentists. If you will take those figures and tabulate them you will find that we are losing from the profession approximately 1,900 dentists per year. How many are we graduating? Last year we graduated 898. This year we have in the forty-five dental schools of the country 1,939 senior students. If we graduated every one of them we would just meet the wastage this year, but we fail to graduate between 10 and 11 per cent. That is a figure that runs over a long period of years, and 15.1 per cent of them fail to pass the state boards at first, and half of that number at any time.

We have also 1,916 junior students in

the schools of this country this year. With the normal wastage of students, and the normal wastage of practitioners, if we lived up to the standards in graduation that we have over the past ten or twelve years, we will have in this country from twelve to fifteen hundred fewer dentists at the end of 1922 than we had in the beginning of 1920. Take those figures into consideration before you rush into something and ask for something that a little later on you will find you do not want.

Take also into consideration the factor of public education, public dental education, the increase in the demand for dentistry all over this country, and you will find that instead of our needing to make it harder and to make the entrance requirements more stringent, that we need twice as many schools as we have and five times as many dentists practicing the right kind of dentistry in this country to meet the demands that we as a profession are today creating among the public.

Part of the subject was the need for trained dental teachers. One field in dental education has been neglected, in my estimation, and that is the recognition on the part of the members of the dental profession for the preparation of dentists to teach every subject that is taught in the dental curriculum. I believe that if it is necessary for us to study anatomy, if it is necessary for a dentist or a dental student to study and to know the principles of physiology, then we ought to have men interested enough to teach those subjects. If there is something there for the student and the practitioner, there is certainly something there for the teacher, and what we need as a profession is to develop within our own ranks teachers of all the dental subjects so that we may as a profession be absolutely independent of any other profession, so that we may teach and study those subjects not only for what they contain themselves but for the truth that they contain as viewed from the needs of dentistry. I do not believe that many teachers who are not dentists are able to teach those subjects intelligently or to secure from them what the subjects themselves possess of value for dentistry.

If we must have more schools we certainly must have more teachers, and some plan must be devised for interesting our young men to take up dental teaching as a life-work, not as a pastime, not as a side issue, but as something that will offer as much in return in the way of satisfaction in their life's work as anything else they can take up, and I know of nothing that presents a larger field, greater opportunities and more important opportunities than dental education. Also I know of no field in which a real teacher can do more good in the development of a great profession, in the development of the units, the individuals who make up that profession, than a great teacher, and we are here to pay our respects and our honor to one of the greatest teachers we have ever had in the dental profession, Dr. Johnson. (Applause.)

The Toastmaster: The next speaker on the program is a man who has ever been known as a friend of dentistry. He has been long associated with Dr. Johnson in many of his public service activities. Therefore, it is with good pleasure that I call before you now a physician, Dr. William A. Evans.

Dr. Johnson, the Citizen

By William A. Evans, Chicago, Illinois

What is a good citizen? In this country we pour out our honors for those who accomplish great things for themselves, for those who amass great fortunes, or even gather for themselves substance in other lines, great honors, if you please. We are essentially a pragmatic people, a practical people, and people from other

lands who view our civilization, as they see the great head lands that stand out—the great Gibraltars that come to represent in the minds of the world the civilization of America—as even they contemplate these men of great accomplishments, are reminded of the fact that their accomplishments have been built in the main upon the selfish. There is, in spite of everything that can be said for them, something of sordidness about that which they have accomplished, and men from other civilizations have not infrequently asked, where is the background for American civilization? A civilization cannot exist, cannot persist, unless these great outstanding characters, these great outstanding accomplishments are woven together by the lives of men, by the acts, the deeds of men who are less selfish, less practical and less pragmatic, if you please.

Somehow in our history it has always been that from somewhere, God only knows where, there rise up men to meet the emergencies that have come. Perhaps we have always been a fortunate people; be the explanation what it may, the fact remains that for every time of stress thru which our people have gone there have risen up from somewhere, somehow, altruistic men, who driven by their love of their fellow-man, by their willingness to do for the common good, have not only cemented the individualistic lives of these others, but have molded our civilization into the accomplishment of successful purpose. There are men who get their greatest pleasure in serving their fellow-men. I would not, on the one hand, have men give themselves over altogether to the altruistc, for to do so would represent bad judgment, nor on the other hand should men give themselves altogether over to selfish accomplishment, for that, too, would represent bad judgment, but there is among our people a great substratum, a great background, if you please, of men who balance self-interest and public interest, and do it with accuracy and with judgment, and those are the men who constitute our good citizens.

Men from Pittsburgh and from Dubuque and from Los Angeles and from all parts of this country, will tell you of Dr. Johnson as a teacher, of Dr. Johnson as a practitioner, of Dr. Johnson as an educator, of Dr. Johnson as a dentist. They will tell you of the accomplishments and capacity of Dr. Johnson in his chosen profession, rendering service to the men and women of his profession, rendering service thru that profession to society at large.

It is my object to tell you of the altruistic side of Dr. Johnson, of the service that he more directly renders not only to this community but to the peoples of all parts of this country. I have been in public affairs in this community for at least twenty years. It has been my observation that whenever in the organization of community efforts it was appropriate that some one should come forward and carry that part of the community load, belonging to the dentist the man that stepped forward was the man whom we are meeting to honor. (Applause.) Therefore, as these men come here from Pittsburgh, from Los Angeles, from Dubuque, and from all parts of the country to tell you of the tender love, the admiration, and the reverence that is your portion among the dentists in the communities from which they come, I come here to speak in the name of my profession, in the name of those who work in public health and in the name of the people at large.

The members of my profession, the medical profession, are rendering better service to those that serve by reason of what they have learned from the dental profession, and particularly from its great leader, Dr. C. N. Johnson. I served as health commissioner of this city when it was proposed that dental hygiene, care of the teeth and mouths of

people of this city, should be adopted as one part of the program of the Department of Health, and when the dental profession was called upon to take charge of that duty, the man that first came into our minds, the man on whom we first called was Dr. C. N. Johnson. (Applause.)

I am sure the school children, the entire school system would join me if they knew that I spoke here as a representative of the citizenship of Chicago, bringing their greetings to your guest. That great body of people who are served by the good citizens, who are the beneficiaries, for whom the light shines because unselfish men, good citizens do their duty as good citizens are with me in spirit as I bring you their greetings and this spoken word of their appreciation. Some of them are known to you and some of them know of you, but gathered in the list are men and women here and elsewhere who may never know just how the good has come into their lives, may never know just how it has come about that they have been benefited. They may not be conscious of the reasons for gratitude which are there, but yet they sense the gratitude in their inner souls. So, in the name of the medical profession, in the name of the public health profession, in the name of the good citizens of the city of Chicago, I bring you greetings when those who know and love you best gather to do you honor. (Applause.)

The Toastmaster: The next speaker was selected to discuss his theme, because he has lived the kind of life, he has practiced dentistry in the same manner, and spirit that the guest of honor has practiced dentistry.

Dr. Johnson, the Practioner

By John V. Conzett, Dubuque, Iowa

A man may be king on a throne so rare
  And yet be naught but a boor;
And he may have money beyond compare
  Yet still be dreadfully poor.

And his brow may wear the chaplet of fame,
  All men desire his place;
The great of the earth may bow to his name,
  Yet he may end in disgrace.

A man all power and strength may possess,
  The strong his favor may seek;
In physical feats have great success,
  An yet be woefully weak.

The pleasures of life a man may obtain
  All blessings that ever man had;
And all that's worth while been able to gain
  And yet his life may be sad.

And he may acquire the best things of earth
  And hold them too, if he can;
Have pleasure and love, all of wealth and mirth
  Yet fail; if he's not a man.

In the last great work accomplished by God
  Pursuing creation's plan,
The greatest of all, his name to applaud
  Made in His image, a man.

Then if all creation's art and wisdom was man, the nearest approach unto the divine, as the Psalmist has beautifully said:

> What is man, that Thou are mindful of him? And the son of man, that Thou visitest him?
>
> For Thou hast made him a little lower than the angels, and hast crowned him with glory and honor.

The greatest compliment we can pay to anyone is that of a man.

Not every human being has attained unto the full stature of manhood. Indeed very few have done so in the full power of the physical and the intellectual and the spiritual nature, and I want to pay tribute to the man that we honor as a real man, a man that we have all learned to love, a man that we have all learned to honor, and so if I come with a leaf for the laurel crown tonight, it will be first that I place that leaf in

that laurel wreath on "The Man," C. N. Johnson. (Applause.)

I can imagine that a man might conquer the whole world and yet not be a man. Alexander the Great failed to conquer himself. I can imagine that a man might be the most famous of his time and yet not be a man, for Napoleon died in St. Helena. I can imagine that a man might be loved by a whole nation and yet not be a man, for Parnell died in disgrace. I can imagine that a man might be the greatest champion of his time, the undefeated champion of his time, and send his challenge in physical combat thruout the whole world, and not be a man, for John L. Sullivan was defeated by John Barleycorn. I can imagine that a man might be a great practitioner, that he might be a great editor, that he might be a great author, and not be a man, but I cannot imagine that a man could be idolized in his own home, beloved by his own profession, be a great author, the leader in his own profession, and a teacher than whom none is greater, and not be a man. That is the accomplishment which we can ascribe to the guest; yet it has only been possible for him to have built this splendid edifice upon the foundation of true, kind, generous manhood.

We all know what Dr. Johnson has been, what Dr. Johnson is as a dentist, and the tremendous influence that he has exerted always upon the whole profession. If we speak of art we speak of a Raphael, or a Rubens, or a Guido; when we go into the gallery of sculpture we speak of a Praxiteles, or a Michelangelo; in music, we speak of a Beethoven, of a Mozart, of a Handel; and in our own profession when we speak of something rare and something beautiful we speak of it as a Johnson, something which has transcended the art of the ordinary man.

His influence has been so great that he has reminded me of one of those great electric cranes which traveled over so great mass of scrap iron that it would take the strength of three or four men to lift. That crane came over, went down to that scrap iron and the power turned on, and seemingly as light as a feather those enormous masses of iron rose from the earth and attached themselves to that tremendous magnet, to be lifted up and carried wheresoever the operator wished.

So Dr. Johnson, in his life and his influence upon the dental profession, has reached down and has lifted up the ordinary man and the profession beyond themselves into the realms of a higher and more ethical and better dentistry. We know something of the electric magnet and something of how it functions. We know that if we take a piece of soft wire and wrap it around we have a unit of the electric magnet, and as the electro motor force goes thru that as we make another turn we increase it and we double the strength of that magnet. Every time we take a turn of the wire around that central core we increase the power of that magnet, so that these great tremendous magnets are made up of cores of iron around which are multitudinous wrappings of insulated wire. And so it is in the character of this man. Around the core of his kind nature he has wrapped the wire of study, the wire of research, the wire of industry, the wire of ability, the wire of kindliness and generosity, and then, thru these multitudinous windings he has sent a potential of his love, and he has made a magnet which has drawn all men to him.

Only upon two occasions have I heard Dr. Johnson use any stricture concerning his fellow-practitioners and that was when he inveighed against a dishonest fellow who was simply working for money and was not working for the benefit of his fellow-man, and the second case is the individual who was

striving to get something for that which he was not giving service.

Several years ago, when the men of the Iowa State Dental Society tendered me a complimentary banquet, Dr. Johnson was not able to be present at that time, but wrote a very complimentary letter and at the end of which was a poem. I am going to pay him back in his own coin by reading a little tribute in verse to Dr. Johnson.

TRIBUTE TO DR. C. N. JOHNSON

As we travel along the highway of life
With our eyes firmly fixed on the goal,
Our hearts are made faint with the turmoil and strife
Which plumbs the real depths of the soul.

We find our eyes dim with the fog and the mist
Of ignorance dark as the night,
And hoping tho blindly, some soul to enlist
To lead us out into the light.

If you seek you shall find some one kind and true
That perfectly knows the great way
And in wisdom and love will be unto you
A guide into truth's perfect day.

To this city have come many lads in the past
Their hearts with ambition afire,
But to find withered hopes, their feet hard and fast
In the slough of failure's deep mire.

Unto many a lad with heart all forlorn
Of hope and ambition despaired,
Has come a new light when this thought was born,
There's some one that really cared.

For the man that we love and honor tonight
Has always been ready to give,
Not only to give, but ready to fight
That a boy's ambition might live.

And scattered about this whole world around
In plain land and mountain above,
The men he has helped are everywhere found,
And everywhere send him their love.

For he that is greatest 'tis very well known
Is he that serves truest and best
And he that loves most, it is easily shown,
Will surely lead all of the rest.

So here's to our hero, the man that loves most
And the man that we love in return.
In the hearts of the thousands, an unnumbered host
The fires of true love shall burn.

The Toastmaster: One of the teachers in Dr. Johnson's old dental school in Canada, Dr. Wallace Seccombe, of Toronto, Canada, will address us.

DR. JOHNSON AND HIS NATIVE LAND

By Wallace Seccombe, Toronto, Canada

I never come to Chicago but what I obtain a great inspiration and a great enjoyment but I can truthfully say that this is the greatest meeting I ever attended in the city of Chicago. I believe I was never at such a wonderful dental meeting before.

One of the gentlemen said this afternoon, it makes no difference what they say about Dr. Johnson it is all true.

Now is the time, O friend,
No longer wait to scatter loving smiles and words of cheer,
To those around whose lives are now so dear,
That may not meet you in the coming year,
Now is the time.

A few days ago at the close of a lecture to one of the classes at the college I told them of the banquet and asked if they had a message for Dr. Johnson, and the message I bring Dr. Johnson is this: "Give our love to Dr. Johnson," and I bring Dr. Johnson not only the love of all of the undergraduates of Canadian colleges, but of the graduates as well, their love, their esteem, their kindest respect to him whom they look to as one of the great leaders of the dental profession.

We have all enjoyed the very eloquent addresses. We have learned something of Dr. Johnson as a man, Dr. Johnson as a practitioner, Dr. Johnson as a good citizen, and he has been and is a good citizen as well as a good dentist, but it seems to me that we must also appreci-

ate Dr. Johnson as a great leader. It has been said and said truly that the history of a nation is the history of its great men. The history of a profession is the history of our great men and of our leaders, and I believe that great as has been the service rendered by Dr. Johnson in these other activities, the greatest service possibly has been his service of leadership. Wherever you go, you will find that the dental profession is linked together in a spirit of friendship and fraternity, and doubtless this is because of the fact that we are banded together to carry on an integral part of the great public health movement, which in itself would band us together as dentists. But back of that we must recognize the great service which has been rendered by our leaders; as Dr. Johnson has gone about among the dental profession here and there and everywhere he has disseminated something of his personality, something of his kindly spirit, and the dental profession not only in Canada but in the United States and thruout the world has learned to love Dr. Johnson.

I had the pleasure a few weeks ago of attending the meeting of the State Dental Society of Oklahoma. The president was referring to a kindly act, an act which he felt deserved comment. When he had finished he said: "That is just like Dr. Johnson." I never heard a greater tribute to any man. He himself hundreds of miles away was having his name linked with this kindly, unselfish, gracious act that occurred in connection with one of the dental society meetings. Unconsciously we link with the name of Dr. Johnson every act of kindness and of generosity in the profession.

There are some of us in Canada who, because Dr. Johnson was born in Canada, because he was graduated from a Canadian college, because he practiced for some years in Canada, would claim Dr. Johnson as a Canadian, but neither the United States nor Canada can claim Dr. Johnson. I am sure that we will all agree that he belongs to the whole dental profession of the whole world. (Applause). Dr. Evans referred very eloquently to Dr. Johnson's heart as large as humanity, and in this larger sense we must, even as a dental profession give up Dr. Johnson because he belongs to humanity.

I had occasion to learn that forty years ago, while he was a student, Dr. Johnson inserted for his own father a gold foil filling which is still giving good service. I remember when I was a dental student learning something of Dr. Johnson; his name in those days was associated with the foil filling. Why was it that Dr. Johnson chose gold, while other men chose the alloy? Was it not significant, is it not an evidence of the character of the man? Would you not expect Dr. Johnson to choose pure gold? I have thought of those gold foil fillings which were inserted back in my country in those early days. I have thought of them as golden threads which speak today of the unselfish, painstaking, efficient service rendered by Dr. C. N. Johnson. But there is also another golden thread which Dr. Johnson has left behind him as he has passed thru from day to day, and that is these kindly acts of unselfishness which have been distributed with lavish hand upon all of those with whom he has come in contact. His life has been an inspiration to us. Even to the younger men his life is an example which we may follow.

> Lives of great men all remind us
> We can make our lives sublime
> And departing, leave behind us
> Footprints on the sands of time.

The Toastmaster: It is appropriate if "Dr. Johnson, the Author and Editor," is to be considered, he should be discussed as such by one who has justly earned an enviable reputation as an editor of one of the greatest dental journals of our time. The man who is to respond to this toast has been able in little less than a decade to bring into reality a journal dreamed and idealized for three-quarters of a century. Historians will record that Dr. King not only founded but established and is now editing the most successful dental journal with which our dental profession has ever been acquainted.

Dr. C. N. Johnson, Author and Editor

By Otto U. King, Chicago, Illinois

Dr. Johnson,

One never knows
How far a word of kindness goes;
One never sees
How far a smile of friendship flees.
Down, thru the years,
The deep forgotten reappears.

Last Wednesday in Evanston I saw the life boat crew dragging Lake Michigan in an endeavor to locate the body of a drowned boy. I was reminded again of the sinking of the "Lady Elgin" at nearly the same location. The "Lady Elgin" was thronged with happy excursionists returning to their homes. Suddenly the boat stopped and began slowly to go down. Only a few hundred yards, yet it might as well have been miles. The crowds upon the shore watched the sinking ship, powerless to help. But two brothers, students at Northwestern University, plunged thru the crowd with ropes. Nat, the elder, a powerful man and a trained swimmer, fastened the rope about his waist and leaped into the waves. A moment later he plunged back again with a woman in his arms. Again he plunged in, and again, and again. Seventeen women and children he brought ashore, one after the other. Then he sank to the ground exhausted. But the cries rang in his ears. After a moment he raised himself and again plunged in. Twenty-three human lives Nat Spencer saved before his strength entirely left him. He was carried to his bed, exhausted and almost out of his mind.

It was many weeks before he left that bed. Most of the time he was delirious. The twenty-three whom he had saved had scattered to their homes. The bodies of the three hundred who were lost had been tossed up by the sea; the nation had begun to forget the tragedy. But the twenty-three whom he had saved, surely they did not forget. Surely they were grateful. This is the simple, solemn truth about those twenty-three; not one of them ever came back to thank Nat Spencer for what he had done. Not one of them even wrote him a letter. Nat Spencer went out into life an invalid, having given the strength of his youth for twenty-three human beings who did not so much as say "thank you."

Post-mortem Kindness

Save not your words of gratitude or praise
Until in death I cannot hear;
For then no eulogy or honeyed phrase
Can soothe my heart or charm my ear;
One word of hearty commendation now
Will bring more comfort, joy and cheer,
Than laurel crown then placed upon my brow,
Or flowers piled around my bier.

There is a legend of a wonderful magic mirror which pilgrims used to travel from all parts of the world to look into. This mirror was supposed to reflect pictures of people as they really were. One time a pilgrim to the magic mirror was a man who was extremely modest and inclined to underestimate himself. He was much surprised to see a new phase of himself.

Dr. Johnson, the alumni of this great dental college whose history will show that it has been one of the real educational forces in dentistry, together with the present leaders of dental thought and activity, have stopped from their many duties and activities of life to pay just tribute to a noble character. The men and women gathered here are to be congratulated, for they are doing themselves honor in trying to say it with flowers while we have you with us.

We are bringing in to this testimonial banquet this magic mirror, which will clearly outline and reflect the superb man and dentist we know you to be.

This splendid banquet will be even better than the magic mirror of the legend, for it will not only review your achievements for the advancement of dentistry and reflect your true character as a man and gentleman, but it will, like an X-ray, allow you to peer into the very depths of your being, and see the great within of yourself with all your unminded wealth, all your potencies and possibilities yet undeveloped. By showing what you are capable of doing, it will build up your ambition and faith in yourself and help you not only to bring out the best that is in you, but to insure continued advancement to dentistry and thus greater relief to suffering humanity.

A Look Back

You have packed up your duffle and put out your fire,
There is nothing ahead but the trail
But the trail that leads up to the hill you desire—
You will come nevermore to the vale.
'Twas a shelter from storm and a home for the night,
'Twas a place for a fire and a snack;
You are thru with it now, you are off with the light—
But you stop and you take a look back.

And this life is just that from beginning to end:
It's a camp, and a hike, and a camp.
It is greeting a stranger, farewell to a friend,
Ev'ry morning new timber to tramp.
For we cannot remain and we cannot return,
We must follow Old Time in his track;
But the campfires of old in our memory burn—
And we stop and we take a look back.

On a recent western trip, we left Denver very early in the morning with the keen anticipation of enjoying one of the big days that come but a few times in one's life. It was an ideal day for a trip thru the Rocky mountains. After we had traveled several hours we were informed by the guide on the train that in a short time we could see Pike's Peak. Almost immediately after this announcement we came thru a mountain pass and I saw what seemed to me to be a big hill. Surely this could not be Pike's Peak! With the realization that we had attained the heights came a sense of disappointment. Its magnificence and significance were momentarily lost to us. Because of the constant gradual ascent up the mountain we had not noticed its steepness nor its greatness. However, as we traveled farther away from Pike's Peak we were greatly surprised to note its grandeur and its loftiness. It stood out in bold relief and towered above the near-by peaks.

How well this illustrates the inconsequental consideration we give to the great men in our midst! Our friendship with Dr. Johnson, the honored guest, has been a constant and gradual one up life's mountain. He has lived with us as our professional brother and loyal friend and companion for so many years that many of us have failed to grasp his greatness, and have failed to properly appreciate his loftiness. Tonight we are stepping back, so to speak, in order to get the proper perspective of his life.

It does one good to step back and get a perspective of the men who have made dentistry from the time of Hypocrates to the present time. History is written from the perspective. A man usually

has to die in order that the complete measure of his life work may be calmly viewed and taken. It is then that the trifles and the unimportant matters are absorbed by the nobler qualities of character. It is then that the rugged features that made his life dominant remain clear-cut marks on the horizon of history.

After carefully noting the work of Dr. Johnson in the various fields, I find him to possess the qualifications of a genius; he has done work from the literary and educational standpoint of dentistry that will cause him to stand out like a Pike's Peak among the great men who have graced our noble profession.

In retracing my steps to get the proper view of Dr. Johnson's life's work, I remember distinctly the first time I met him. It was at the time of the big meeting of the Chicago Odontographic Society in 1897. During the discussion of a paper, one of the discussers unfortunately criticized the technical ability of the dentists of Chicago. Dr. Johnson, with the spirit of a Roman, ably defended the honor of his Chicago associates. No one in the history of dentistry has ever discussed as many papers as Dr. Johnson. A careful review of dental literature will show that he has opened the discussion of a large percentage of the papers that have been read before the old Chicago Odontographic Society, the Chicago Dental Society, and the Illinois State Dental Society. Invariably, when some distinguished guest appeared before any of these societies, Dr. Johnson was delegated to open the discussion. This, in itself, is quite significant in that the universal opinion of dentists in Chicago has always been that Dr. Johnson was pre-eminently qualified to represent the real progress of dentistry in this great Middle West. He, among all others, was recognized as a great author, educator and teacher. Dr. Johnson has written over 550 editorials and nearly 200 original articles.

In the field of dental editorial work, Dr. Johnson has ably served as editor of *Dental Review* for a great many years and was engaged in that capacity when this magazine suspended publication in 1919. He was editor of the *Burr* for six years and is at the present time a contributing editor of *Oral Health;* he also holds the editorship of *Desmos,* a dental fraternity publication.

Dr. Johnson's book on *Operative Dentistry* will ever stand out as a monumental work for the profession and will cause his name to be recorded as one of the really great operators in dental history. His book on *Success in Dentistry* has played a very important part in teaching the dental profession thrift, thus giving the profession an insight into some of the fundamental problems in dental economics. Surely the future dental historian will record Dr. Johnson's name as a great dentist who lived during the nineteenth and twentieth centuries.

On the dental highway of progress, our guest has been a beacon light to thousands of dentists, many of whom have been his students.

There is another significant fact about Dr. Johnson's literary talent that should be stressed. He has not only contributed a great number of editorials and papers but he has manifested a more versatile talent in that his writings have covered a greater variety of subjects than those of any other man in the annals of dentistry.

A careful review of secular literature indicates that Dr. Johnson has contributed to publications outside of dentistry. Many of his letters and poems have been published, and still others are as yet unpublished.

It occurs to me that the richness of this man's personality may be better visualized by some apt quotations. Recently, a testimonial dinner was given to

a dentist in the Middle West. Dr. Johnson was unable to attend but he gave me a letter to be read on that occasion. I especially desire that you notice how well this little excerpt typifies the kindness and unselfishness of Dr. Johnson himself:

> **He has been friendly with the young** man, companionable with the middle-aged, and compassionate with the elderly. He has stooped to pick a flower from the pathway of life to place it on the breast of his fellow-man. He has spoken a kind word as he passed along, and has distributed his favors to men while they were still living. He has been generous of his praise, prodigal of his help, and lavish of his affections. He has stooped to aid a fallen comrade whenever he saw one down, and his put a prop under those whom he found trembling in the balance.

I have read and re-read several times his "Open Letter to the Mother of a Drafted Boy." Observe how, like a Lincoln, he gives encouragement to the mothers whose boys were drafted into service during the Great War:

> **Human life is very dear, and** yet you would willingly lay down your life for your boy. You even placed it in jeopardy, cheerfully, gladly, when you brought him into the world. Self-sacrifice is the sublimest sentiment of which human nature is capable, and no individual or nation is safe without it. And remember this, just as soon as an individual or a nation begins to hold life in greater esteem than it does principle or devotion to duty, just so soon is there an inward disintegration of character which is the sure precursor of deterioration and decline. Had it not been for the conviction in the minds of the founders of this country that human life was less in importance than the establishment of high ethical standards of life and administration, you and I should not now be enjoying the privileges of a free and liberal form of government.
>
> **As a mother you have before you a terrible** conflict. You have the conflict which is inevitable between the yearning motherly love which has hovered over your boy and protected him during all the years of his young life—the conflict between this and the nobler, grander sentiment which prompts you to offer the most precious possession of your heart to the great aching world, casting your lot with the noble army of mothers whose self-sacrifice and abnegation have been the one sublime heroic fact in all the ages past.
>
> **I wish with all my heart that I could aid you in your coming conflict. I would willingly lose much sleep and suffer much pain to help you, but it is the penalty and glory of your** motherhood that the decision must be yours **and yours alone. The consolation is that when the victory is won it will be *your* victory—no one can take that solace from you.**

An excerpt from his poem "The Father's Farewell" will touch the heart of every father and every son. And I am sure that there is meat for retrospect in it for each one of us as we review our own lives.

THE FATHER'S FAREWELL

So you're bound ter leave the homestead—the
old log house an' barn?
Ye think there's somethin' better fer a likely
chap ter larn
'N turnin' up a furrer with a stubborn yoke
o' steers,
Or trampin' in a haymow, like *I've* done all
my years?

Sense ye're bound ter try yer fortune off in
the world alone,
Tackle everything afore ye with a will as hard
as stone.
Jest buckle up yer galluses an' show yer
native pluck;
Pitchin' inter things real spunky's jest an-
other name fer luck.

Same as 'twas back thirty year—*except* 'at
now we're *old,*
Our hearts a-gittin' warmer while the years
seem growin' cold.
But son, yer train's a comin'—must be some-
thin' in my eye—
You'll let us hear—you'll come—you'll—God
bless ye son! Good-bye.

Ever since I read of Dr. Johnson's automobile trip to the National Dental Association meeting in 1911, I have always had a desire to meet the Indian and the Collector in the story. Several years ago, I met the Indian but it was only last Monday night that I was fortunate enough enough to sit beside the Collector at a banquet. Her reply to my question as to how her father was able to write the hundreds of little messages to us on such occasions as our birthdays, or when the baby came, or for a fiftieth anniversary, or when we returned from

some long trip, or when we had written an article that he thought had merit in it, can be summarized in excerpts from her father's poem "My Hour."

MY HOUR

There's an hour not recorded by the clocks of standard time,
Not remembrancer of summer nor a hint of winter's rime.
It's an hour quite creative—by a myriad fancies fed,
When the embers slowly smoulder, and the folks are all in bed.

Then I'm king in my dominion, with a little desk my throne,
Swarmed about by countless subjects, tho I seem to sit alone;
And I hold such sweet communion with the play-folk of my head,
When the night winds softly murmur and the real folk are in bed.

Thus I sit in waking dreamland as the moments steal away,
Quite unconscious, while the clock is striking in another day.
What though half I think's unwritten, and the other half unread,
Priceless is this cherished hour when the folks are all in bed.

What father's or mother's heart will not be deeply touched by listening to this passage:

HOLDING BABY'S HAND

Oft I'm sitting in the twilight
Close beside a trundle bed,
Where a pillow soft and snowy
Bears a little curly head.

Thus ordained am I to pilot,
Without staff and without rod,
Such a royal little traveler
To the wondrous Land of Nod.

In the world's great strife and battle
I but make a sorry fight;
In the world's illumination
I but shed a feeble light.

Yet while void of force exalted
Great enough to stir the land,
I've a mission meek but mighty—
I can hold a baby's hand.

And here is an extract from another, chosen at random from the great number of poems written about children:

WHAT IS HOME WITHOUT THE CHILDREN?

What is home without the children?
Just a place to sleep and eat;
Everything so still—and tidy,
Everything so drear—and neat.

Not a little shoe or stocking
Flung at random on the floor,
Not a string for driving horses
Fastened to the bedroom door.

Not a dozen little trinkets
Lying scattered everywhere,
Not a little peal of laughter,
Not a sheen of golden hair.

Old folks dreaming in their dotage,
Settling down to fogy ways;
Not a prank to shock them mildly—
Make them think of other days.

What is home without the children?
Just an egg without the meat—
Just a nut without the kernel—
Just a sun without the heat.

Dr. Johnson, there is something about you we like and this is the highest tribute I can pay you. May I make my meaning clear by an illustration?

One night, during the National meeting in New York, a violinist stood up to play in a cafe. There had been much music all evening to which no one listened. He had played but a few strains when the chatter of tongues and the clatter of dishes ceased. Every one listened. When the last notes died away in a sad little cadence, there was a moment of hushed silence, for there were tears in every eye, then came a burst of warm applause. For there is fiddling and fiddling, but it is the added something that reaches the heart.

During the World's Fair, there hung in the Fine Arts Building the paintings of great artists, pictures with perfect technic and some that won the prize. But in one corner the crowd gathered all day long around a small picture of a boy leaving the old home, and many an eye was moist as it turned away. I do not know what technical excellency it lacked but it made its appeal to men and women. took their souls—for it had the added something.

Many years ago I witnessed an unusual demonstration of the power of oratory. It was on a Sunday afternoon at the Palmer House corner that a Salvation Army lass, mounted on a box, interpreted in a simple but magnetic manner the meaning of life. The street was crowded with listeners intent on hearing this message—unusual only in its narration, for she seemed possessed of a power, a something that touched one, that kindled every soul anew. Her personality, her sincerity, and her simple but earnest faith reached into the hearts of everyone. For she too had that "added something."

Dr. Johnson, as an editor, a poet and above all as a man, you have advanced the cause of dentitsry and helped give to it poise and character. You have inspired and encouraged men to love dentistry—your friends know that you have the "added something."

I am sure that everyone who knows our guest will wish for him when he arrives in the Great Beyond that he may be awakened in the manner which he has so graphically portrayed in the poem "My little Caller"—by the angelic spirit of the child.

MY LITTLE CALLER

Comes a ray of human sunshine,
  Stealing softly to my bed,
Reaching up on little tiptoes,
  Tugging gently at the spread.

When I sleep my last long slumber,
  All I ask to seal my bliss
Is that somewhere I'll be wakened
  By an angel voice like this.

TO DR. C. N. JOHNSON.

As we travel along life's pathway,
  We need friends just like you,
Who radiate the sunshine
  And great things always do.

Your inspiration gives us charm
  That lures to better living;
We need the words of cheer
  That you are always giving.

We like to have you take our hands
  In a warm and kindly grasp;
It makes us feel you are a friend
  When our hands together clasp.

You have given of your knowledge
  That the whole world should gain.
Your work will live forever;
  The sacrifice is not in vain.

Mere words cannot quite express
  What we all think of you;
Better friend man never had
  Than Doctor Johnson, tried and true.

(Applause.)

The Toastmaster: Dr. Buckley, who is Dr. Johnson's and my dearest friend, will speak.

DR. JOHNSON, THE TEACHER

By John Buckley, Los Angeles, California

To travel from California to help honor a man like C. N. Johnson requires the least effort of anything that I can do. (Applause.) It will be difficult for me to speak of any phase of the life and character of our beloved guest without mention of many personal incidents which have linked his life to mine.

It was in the fall of 1896, within a few months now of being just twenty-five years ago, that I first met this modest, kind, thoughtful and considerate gentleman. It did not take us long in the lecture room to realize that in him we had a real teacher, one who possessed every qualification as such, and it is to the qualifications of Dr. Johnson along this line that I am privileged to speak.

The profession of dentistry is rapidly coming into its own. So rapidly are we making progress that never before in our history did we need men of forethought and men of vision as we need such men today. It was Alfred Tennyson who said:

For I dipped into the future, far as human eye could see,
Saw the vision of the world, and all the wonders that were to be.

There never was a time in the history of the world when we needed men who *could* dip into the future and see what it is to be, as we need these men today. The world at large needs them to help solve the many knotty problems of reconstruction, and for the same reason we need them in dentistry. The men who are needed most with us, as has been emphasized by previous speakers, are those who are willing and capable of teaching others. I am therefore pleased to discuss the dental teacher and to be able to point to C. N. Johnson as the ideal.

Those of you who have given this subject any thought and consideration at all or who have had any experience along the line of teaching must have long since concluded that there are at least three outstanding qualifications of the successful teacher, not to mention the one hundred and one essential details which enter into the teaching process. He must be able to impart knowledge; he must command the respect and hold the attention of his students; and he must leave the students with a burning desire for further knowledge of the subject taught and the desire to seek such knowledge along the lines of truth.

Let us see how our subject measures up to this high standard. First, a teacher must be able to impart knowledge. Before one can impart knowledge to others he must first possess that knowledge himself, and to him it must be old knowledge. This suggests at once the necessity of the teacher's familiarity with the subject-matter of instruction. Did any of you ever sit and listen to a lecture by Dr. Johnson and have the feeling that he was not familiar with the subject-matter under discussion? I know you did not, for he never permitted himself to go into the lecture room unless he was prepared to give the latest and the best, always reserving the right to use his own good judgment as to what was the best for his boys to know.

I wonder if you have ever learned that there is a difference between the fancied pleasures of life and the real pleasures, or those things that bring real happiness? The greatest pleasure or happiness in life comes from the consciousness of realizing ideals, and the teacher who gets the greatest happiness and enjoyment out of his work is the man or women who is conscious of realizing some ideal set up in the lives of his or her students. Surely that teacher is the happiest who feels that, in the process of teaching, the highest good, the greatest and noblest in life is being realized by the one taught. The teacher who seeks this kind of happiness and who hopes to find the reward of his labor in the thing done, and who expects to thrill the student with the joy of real growth and activity must find the secret in the consciousness of realizing the highest good in life; in ministering unto the deepest cravings of the soul for truth, beauty and virtue. Thomkins in his *Philosophy of Teaching* forms a definition and says that teaching is the conscious process of producing mental experience for the purpose of life development; or, he says teaching is the process by which one mind from set purpose produces the life-unfolding process in another. By his familiarity with the subject taught and his deep knowledge of that under consideration, Dr. Johnson, the teacher, has ever produced the life-unfolding process in the minds of his students.

Let us consider the second qualification of the successful teacher, commanding the respect and holding the attention of the student. In the twenty-five years that I have known this man I have been privileged the greater portion

of those years, to have taught the same boys that Dr. Johnson has taught. I have associated with them in college, and I have associated with them in the profession, after they have gone out into the broad and active world, and I can stand here and say to you that in all these years I have never yet heard one of Dr. Johnson's students make a disrespectful or disparaging remark about him. (Applause.)

C. N. Johnson is the most beloved man in dentistry today. There is no doubt about that. (Applause.) He is loved because the purity of his life and the nobility of his character command respect. Without any conscious effort on his part he has the happy faculty of making friends of all whom he meets, and it is that peculiar, characteristic kind of friendship which gradually ripens into love. There are two ways by means of which the teacher can gain and hold the attention of his student. One can accomplish this end by constantly preying upon the curiosity of the student. The teacher who resorts to story-telling in the lecture room may succeed in holding the attention of his class but he is likely to do so at the expense of real teaching. The student may be paying attention because he does not want to miss any of the stories told, not necessarily because he is interested in the subject taught. The real teacher never needs prey upon the curiosity of his students. He holds their attention, commands their respect, and interests them because he leads them to feel and to know that that which he is teaching has a direct relation to their future lifework. It is something they can use, something that they must have. They want it. This is the real way to interest students and it is the way that C. N. Johnson has ever held the attention of his boys and, in later years, his girls.

The third and last qualification of the teacher is that burning desire which a teacher should leave on the part of the student for further knowledge of the subjects taught. The teacher may have the student under his care but a short time, but during that period, however short, he should leave with him a lifelong tendency to seek the truth. There is no greater evil in education, dental or otherwise, than that of deadening the natural appetite of the student for knowledge. Has anyone ever sat under the magic influence of this man, Dr. Johnson, in the lecture room, in the college infirmary, on the floor of a dental convention, and listened to one of his masterly lectures, and at the end give a sigh of relief? No! On the contrary, he left each of us with that restless longing for truth and righteousness. Witness, if you will, the men who are here, the men that are scattered all over this broad land of ours in the various corners of the world who have received their stimulus to go on and on and on, because of these qualifications of Dr. Johnson, the teacher.

As a teacher C. N. Johnson is the Colonel Parr of the golf course, the horse that won the Derby, the pitcher who retained the pennant, the boxer who wore the belt. As a teacher C. N. Johnson has succeeded, and in teaching, as in every other walk of life, character is the foundation of success. You may have thought that the unusual success of Johnson as a citizen, and practitioner, in his native land, as an author and an editor, was due to the fact that he was a well-educated man. It is true that he is not deficient in education, but in the years to come, of all who will hear of his grand career and of his services to his profession and to his fellow-man, you will not hear that either the high place he reached or that which he ac-

complished was entirely due to his education. On the contrary you will constantly hear, as accounting for his great success in these various walks of life, that he was obedient and affectionate as a son, honest and upright as a citizen, tender and devoted as a husband, kind and considerate as a father, and truthful, generous, unselfish, moral, and clean in every station of life. Never and under no circumstances did he consider any of these attributes too weak for manliness.

I borrow here for the purpose the selected words of Grover Cleveland expressed in behalf of the martyred McKinley, and I feel that I have a right to do so on this occasion for C. N. Johnson is the William McKinley of dentistry.

Let us make no mistake. In him we have a most distinguished man, a great man, a useful man, who became distinguished, great, and useful because he had and retained, unsullied and unimpaired, those qualities of mind and of heart which I fear too many of use keep in the background or have abandoned altogether.

It was Owen Meredith, I think, who said,

No stream from its source flows seaward
How ever so lonely its course
But some land is gladdened;
No sun ever rose and set without influence
Somewhere;
No life can be pure in its purpose
And strong in its strife
That all life is not purer and stronger thereby.

And so Dr. Johnson, the purity of your life and the strength of your character have welded an influence over the lives and character of your thousands of students scattered all over the world which cannot be measured, but we can express in a small degree at least our loyalty to the old school in which you have worked these many years. Dr. Logan, the alumni of the Chicago College of Dental Surgery, has always been proud of the institution. During the years when this school was watched over and directed by that dignified, scholarly, manly man, Dr. Truman W. Brophy (applause) we watched with interest its every step; and now that you, Dr. Logan, have taken over the reins of this institution we, the alumni, look to the future with faith and confidence. We know we will not be disappointed, and on behalf of the alumni of the Chicago College of Dental Surgery I have the pleasure and the great honor of presenting to the college thru you, its dean, this bronze bust of C. N. Johnson, our teacher and our friend. (Applause.)

As a poet I have no such ability as our guest, but if you bear with me for a moment I will do my best.

C. N. Johnson, steady head,
Glory-crowned, divinely led,
In the ages fixed the plan,
To become a glorious man.

Nature strewed with lavish hand
For uplifting of this man.
Rich in mind, with noble thought,
Rich in friends from those he taught.

Man of vision, broad and deep,
To awake the powers that sleep,
Man of brain, and man of brawn,
Man who sees the break of dawn,

You are building for the ages
And on history's future pages,
Thy great record will appear
Standing bold, and firm, and clear.

Anxious thousands read thy story
And their hearts are filled with glory,
Placid age and radiant youth,
Hearken to thy words of truth.

Thy countenance will forever live
In this bronze bust of thee, we give
To our College great and grand
Loyal to the School, we love the man.

In this face we see the heart
Which has ever played the part,
Always warm and full of love
Like the cooing turtle dove.

By thy virtues, strong and bold,
By thy thousand charms untold,
C. N. Johnson, favored, blessed,
Prince of all, we love you best.

(Applause.)

The Toastmaster: If conditions were a bit different I would in a formal way in behalf of the institution accept the gift. I will only say for Dr. Johnson's benefit that one thousand and forty-three of his former students have contributed to this bust. Even from the little picturesque country of Holland came a letter signed by thirteen of his boys.

Response on Behalf of the Alumni of the Chicago College of Dental Surgery

By Calvin S. Case, Chicago, Illinois

I wish I could say all that is in my heart, all that I have thought of saying since I knew that I was to perform some little duty here tonight, but I want to say that of all the men in the profession that have loved Dr. Johnson most, it is his own boys, the alumni of the Chicago College of Dental Surgery.

A very curious thing happened a few days ago. Charley Bentley awakened to the idea that our boys here were not commemorating this banquet in any way. He immediately got busy and went among the alumni in the loop. He told me that he never enjoyed himself so much as he did in visiting the different offices because they simply wanted to pour out everything they possibly could to him when they found out his purpose. So in that way there has been gathered a certain amount with which a beautiful picture, a beautiful painting by a noted artist, has been purchased and has been selected by no less a man than Lorado Taft for this occasion. (The curtain covering the picture was then drawn aside.) It is my honor and my pleasure to present this beautiful picture in behalf of the alumni, and I know that it will not be because of its intrinsic value nor its beauty that you will cherish it but it will be the love that is back of it, from the boys. When you hang that picture upon the wall of your beautiful home when the day is done and the evening approaches and you sit in your easy chair and gaze upon that beautiful picture, the picture itself will lose, in your mind, because in the haze that will arise you will see the faces of the boys whom you love and the boys that love you most, because you have always been such a dear. (Applause.)

Response on Behalf of the Faculty of the Chicago College of Dental Surgery

By Thomas L. Grisamore, Chicago, Illinois

You have been a member of the faculty for more than thirty-five years and it is my very great pleasure to present to you upon this occasion a little token of our appreciation. We hope you will take this watch that I hand you now and wear it and we will be delighted if you will occasionally think of your associates in college work. We know it is not very valuable. We are also aware of the fact that silver and gold are not the only coin, for true virtue, such as you possess, passes current all over the world. (Applause.)

Response on Behalf of the Dental Faculty of the University oe Illinois

By Frederick B. Noyes, Chicago, Illinois

We know Dr. Johnson, that no material thing can express the love and feeling of those of your fellow professional men and teachers and we know, still more, that no material thing is necessary to remind you of their love and affection, but I have here a token in pearls, which are emblematic of the purity and nobility of thought—the noblest of the noble metals to the nobility of the metal of your character. (Applause.)

Response on Behalf of the Faculty of the Northwestern Dental School

By Thomas L. Gilmer, Chicago, Illinois

It seems to me that the word "friend" means more than almost any other word in the English language and that when I class Dr. Johnson as my friend I do it in sincerity because I know that he is my friend. Dr. Johnson, I congratulate you on this splendid audience, these beautiful gifts, these beautiful tributes. You deserve them. I have known you for a third of a century and maybe a little bit more. I have been associated with you very closely and part of that time I was with you in the same building on the same floor and I had a wonderful opportunity to know you. Some of your patients were my patients, some of my patients were yours. They seemed to go back and forth and I was never more happy than when I knew that one of my patients was going to Dr. Johnson, because I knew that he would be treated fairly.

While I was ill some time ago Dr. Johnson was the first to express his sympathy. When I became well again Dr. Johnson was the first to congratulate me. When any good thing has come to me Dr. Johnson has always sent me a word of congratulation, and I cherish those words and have placed them where those that come after me may see them and know that I had such a friend as Dr. Johnson. We have been both associated in school work. We have taught many students. We have conversed very often about the best way of teaching the student. We have never had an inharmonious word. He wished that our school might do the best work and we, in our school, wished that he and his school might do the very best work.

Dr. Johnson, I have been commissioned tonight to give you, as an expression of love of our faculty, for you as a man, as a teacher, a little gift which we hope you will cherish and keep and we want you to remember the love that we bear towards you. I present you with this piece of sterling, because we thought that your sterling nature would require something sterling to represent it. Please accept this from the Northwestern University Dental School as an expression of love from our faculty. (Applause.)

Response on Behalf of the Odontological Society of Chicago

By L. L. Davis, Chicago, Illinois

It is my privilege on behalf of the smallest organization of dentists in the city of Chicago, but one that is very dear to your heart and to mine, to extend to you a token of love and friendship, with which you have always blessed this organization. Dr. Johnson, may you, when using these silver service plates, always think of the Odontological Society of Chicago and your friends. (Applause.)

Response on Behalf of the Los Angeles Dentists

By Thomas P. Hinman, Atlanta, Georgia

I appear before you tonight in a dual capacity. I am respresenting the boys from Los Angeles. That is a long way from where I live in Atlanta, away down south of the Mason-Dixon Line, and yet I am representing those boys because they love you just as well as the fellows away out west. I feel very much in presenting this gift from the boys out in Los Angeles like the nigger in the story. I remember once when I was a little fellow I slipped in the back of a nigger church. I was sitting there in that nigger church and another nigger, not me

(laughter), came in and sat down beside me. In front of me were two women; one had a baby in her arms. The old nigger was preaching; he was telling them about the cold waves of Jordan, how they were going to roll over them, and I saw them getting happy, just like I am, and one of them said "Sal, are you gwine to shout?" "No." "Well hold my baby while Ah shout." (Laughter.)

I know that all your pretty presents are fine but I can tell the other boys that this is the thing he is going to see most. (Laughter and Applause.) Dr. Johnson, on behalf of the boys from Los Angeles, it gives me great pleasure and joy to present to you this desk set and at the same time from the boys south of the Mason and Dixon Line to present to you more love than there is in the world. (Laughter and Applause.)

The Toastmaster: There are many telegrams and letters here and it has been especially requested that we should read them all. We cannot, but we will record them all.

C. N. Johnson, Chicago, Illinois

This is the strangest experience of my young life. (Laughter.) You, in the goodness of your hearts have invited me here as your guest. In the amazing goodness of your hearts you have by your speeches painted the picture of a man. In the inconceivable generosity of your hearts you have attached my name to that picture, and I want to acknowledge at the outset that I do not recognize the fellow at all. (Laughter.) I could not have believed it possible that friends in whom I have the confidence that I have in these friends could be so mistaken about a man. I simply can not live up to the specifications.

You have done this for me, tho. You have made me resolve that I shall try in the future to justify in some small measure, the estimate you have placed upon me. I don't like to talk about myself, but you have left me no alternative. By the things you have done and the things you have said you have constituted me the main guy here. (Laughter.) I suppose I am always thinking on occasions of this kind, about the young men. It is good for you that the time is limited because I have something of a message for the young men that I shall not be able to deliver.

I want to say just this word, however, to the young men that are coming up. I want to promise them that there is a reward always for conscientious effort. It may come in one way, or it may come in another, but I am going to recite just one instance, if I may, to show you what I believe to be the greatest reward that ever comes to a professional man.

Some time ago, a little after twelve o'clock at night, I was called on the phone at my home and the statement was made that there was a woman suffering agony with a tooth, about five miles from where I lived. It so happened that I had not yet gone to bed and they asked if I could not possibly come and see if I could relieve that suffering. They sent a car for me and I went, and when I stepped into that house I found a man pacing back and forth thru the hall in his bathrobe almost out of his mind on account of the suffering of his wife. When I went into the bedroom I saw that woman sitting up in bed with agony pictured on her face, and her first words were: "Dr. Johnson, I think I shall lose my mind." No matter what I did for that woman, it was not fifteen minutes before she began to relax. Within twenty minutes her eyelids drooped and in less than a half-hour she was sound asleep and I was able to leave her. Ladies and gentlemen, the change of expression on that dear woman's face was a greater reward to me than all the money that could be piled

in this room. (Applause.) That is the kind of reward that we get in our professional life.

One other instance, if you will permit me, I want to picture for the boys that are coming along. The older practitioners know these cases, and understand what I mean, because they have had similar experiences. Years ago there was a dear old poor couple who used to come to me as patients from the northwest side. They were loyal, genuine, good people. The old lady came with a shawl around her. They were not cultured, but they were genuine. They began to be feeble, and I suggested after a while that they would better seek a dentist in their own neighborhood because I was fearful that some injury would come to them in the traffic down in the loop, and finally I did prevail upon them to get a dentist in their neighborhood. It was only with the promise that if they got into serious trouble I would take care of them. Of course I promised. One day they came into the office; the old man was lame, it was labor for him to move at all, but they came into the office with a story that the old lady was suffering terribly and had suffered for days with a tooth and she wondered if it was not possible that I could give her relief. I seated her in the chair and I won't tell you what I did except this, that I relieved simply a traumatic occlusion. The dentists who had been caring for her put medicine on the gum and medicine on the gum and of course it did not do any good. That tooth was raised and she said: "Doctor, I can't close my mouth." I said: "Well, I think I will relieve the pressure on that a little bit and it will be all right." "No, you can't touch the tooth," she said. But you know I could touch it and I ground it down and then I said: "Close your mouth," and she tried it, hesitatingly for just a moment, and all at once she opened and closed her mouth with a snap. Her face lighted up and she turned to me and took my hand and placed it to her lips and said "Dr. Johnson, you are an angel." (Laughter.) I would rather have that kind of a tribute from that dear old lady, because as a professional man I gave her relief, than I would to occupy the position of president of the United States. (Applause.)

Those are the rewards. I could mention many of them, but the time is late. I will have to content myself with simply expressing my appreciation and my thanks. I want to thank all of the dear boys. Some of them have come so far that I am overwhelmed. I want to thank my other friends here not of the profession, some of my dear friends outside of dentistry. I want to thank the committee who has worked so hard for this event. I want to thank my good friend at the right, Dean Logan. I am thankful I have not had to room with that fellow in the last few weeks. I will guarantee he has asked Mrs. Logan at three or four o'clock in the morning her opinion about something connected with this banquet. I know him. I have lived with him. I tender him my thanks, and I thank the dear ladies who have come out here to grace this occasion. I wish I could tell you all that there is in my heart. I thank those who have been so generous as to give me these beautiful presents. It will be an inspiration to me as long as I live to do better and better and better.

I am going to close with the recital of a little prayer, about the only prayer I ever make. It is a modification of a prayer you all know, but I seldom turn the light out and place my head upon the pillow that I do not say this:

Now, I lay me down to sleep,
I pray the Lord the faith to keep,
If I should die ere morning's sun
I pray the Lord my work's well done.

(Applause.)

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Editorial Department

THE MILWAUKEE MEETINGS

Year after year the meetings of our great national organizations come, go, and pass on into history—the history that is being made during this very significant period in the development of our beloved profession. The meetings recently held in Milwaukee mark another milestone in our professional progress. At the National Dental Association there were probably a larger number of dentists in attendance than at

any previous meeting, tho the registration at Boston was somewhat greater. The reason for this was that at Boston there was relatively a larger proportion of dental hygienists and women and children.

Milwaukee proved an ideal place in which to hold the meeting, and the local committee of arrangements deserve all praise for the masterly manner in which they handled the situation. They worked incessantly from the day Milwaukee was selected till the last man had left for home after the meeting, and they are entitled to the gratitude of the entire organization. There is a great advantage in having a building where all of the sessions may be held under one roof. At Milwaukee the magnificent Auditorium accommodated the general sessions, the section meetings, the banquet, the clinics, and the exhibits; and there was ample room for all. For instance there was a 30 per cent increase in exhibit space over any previous meeting, and the interest in what the exhibitors had to show was keen thruout.

The sections all had ideal accommodation, and every item of the literary part of the program was carried out according to schedule.

An outstanding feature of the meeting was the fact that five hundred clinicians appeared on the program, and everything was so well organized that the machinery of this immense clinic moved like clockwork. Some of these clinics demonstrated a new outlook in their respective fields, and it is likely that for many years to come we will look back at Milwaukee as having established a definite advance in applied as well as in theoretical knowledge.

At the banquet Tuesday night there were thirteen hundred in attendance and former United States Senator James Hamilton Lewis made a masterly address, well worthy of this splendid occasion.

Surgeon-General Ireland, of Washington, was another distinguished guest of the Association, and presented a splendid paper at one of the evening sessions. The House of Delegates very appropriately, by unanimous vote, elected him to honorary membership in the Association.

The following officers were elected for the ensuing year:

President, Thomas B. Hartzell, Minneapolis, Minn.

President-elect, John P. Buckley, Los Angeles, Cal.

Vice-Presidents, W. R. Wright, Jackson, Miss.; Dayton Dunbar Campbell, Kansas City, Mo.; and Frederick O. Kidd, Fall River, Mass.

Secretary, Otto U. King, Chicago, Ill.

Treasurer, Arthur R. Melendy, Knoxville, Tenn.

The three members of the Board of Trustees were John D. Millikin, San Francisco, re-elected; C. C. Allen, Kansas City, Mo., and R. H. Volland, Iowa City, Iowa.

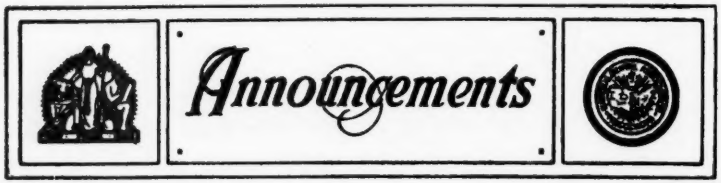
The place selected for meeting in 1922 is Los Angeles, California, the dates, July 17-21. Those who know anything about the proverbial hospitality of California will be enthusiastic about the selection for the next meeting, and every member should begin planning at once to attend.

In line with this very thing President Hartzell inaugurated at Milwaukee a movement which we believe is destined to insure the success of the Los Angeles meeting. He called together the presidents and secretaries of the various state societies, and laid plans for increasing the membership of the National Dental Association to 35,000 during the coming year. This can easily be brought about if all work together in a common purpose. Immediately following the election of the new officers Dr. Hartzell met them with the chairmen of the sections, and outlined the policy for the year, which resulted in the slogan "Dentistry can add ten years to the average of human life." Thus the term "preventive dentistry" is to become an established fact if the proposed program is logically carried out.

Many other organizations held their meetings at Milwaukee during August, notably the Dental Editors' Club. This organization has possibilities for the greatest good in dental literature, and hereafter it is to meet annually for the consideration of such subjects as are of vital interest to editors, and of the greatest significance to the future of dental periodical literature.

Another organization which is destined to have a marked influence on the development of dentistry is the American College of Dentists, an organization having for its object the same ideals in dentistry as the American College of Surgeons has in medicine. Further particulars of this body will be published in our October issue.

All in all, the 1921 meetings of our great national associations will go down in history as marking a distinct advance in the development of dentistry, and it now remains for every individual interested in the profession to begin preparations for the next annual meetings, to the end that they may eclipse even the best that have gone before.



CALENDAR OF MEETINGS

NATIONAL SOCIETIES

American Institute of Dental Teachers, third week in January, 1922, at Montreal, Quebec. Abraham Hoffman, Secretary, 381 Linwood Avenue, Buffalo, N. Y.

STATE SOCIETIES

October

Virginia, at Richmond, (11, 12, 13, 14).

December

Ohio, at Columbus (6, 7, 8).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Connecticut, at Hartford, November 17, 18, 19. Robert H. W. Strang, Recorder, 886 Main Street, Bridgeport.

New Jersey, at Trenton, December 5-9. John C. Forsyth, Secretary, 429 E. State Street, Trenton.

STUDY CLUBS AND OTHER SOCIETIES

Pennsylvania Association of Dental Surgeons, October 12-15, Philadelphia.

PENNSYLVANIA ASSOCIATION OF DENTAL SURGEONS

Clinics and courses for graduate dentists will be held under the auspices of the dental organizations of Philadelphia, in celebration of the seventy-fifth anniversary of the Pennsylvania Association of Dental Surgeons, October 12, 13, 14 and 15, 1921, with headquarters at Bellevue-Stratford Hotel.

The celebration of this event will be attended by the following graduate courses: I. Lectures and Demonstrations on the Conservation of Time and Energy in Office Practice, by Dudley Guilford. II. Certain Features of Prosthetics, by Norman Essig and George Essig. III. Methods of Replacing One or Two Adjacent Teeth, by E. L. Kanaga and Edwin Shoemaker. IV. Preventive Dentistry and the Treatment of Dental Periclasia, by William A. Jaquette, J. Clarence Salvas, and Dudley Guilford. V. Principles of Anaesthesia, Exodontia, and Oral Surgery Applicable to General Dental Practice, by James R. Cameron, Robert Ivy, Agnew Irwin and George Coleman. VI. Cavity Preparation and the Manipulation of Filling Materials, by Charles Jaco, O. G. L. Lewis and Wilson Zerfing. VII. Diagnosis and Procedure in Pulpless Teeth, by Emerson Sausser, Albert A. Mulford and J. L. Appleton, Jr. VIII. Porcelain Inlays, Special Porcelain Crowns, by William A. Capon and John Burkhardt, Jr. A fee of twenty-five dollars will be charged for three full courses, i. e., the evening course, one morning and one afternoon course, as selected by the applicant. Those subscribing will be entitled to attend all the clinics. A complete program with full details will be forwarded to the profession early in September.

The following is a partial list of the clinics: "Microscope Technic and Findings," by M. T. Barrett; "Movable Clasps," by R. G. Beale; "Inlay Bridge-Work," by G. A. Coleman; "Extension Saddle," by A. C. Eglin; "Impression Taking," by F. A. Fox; "Microscope in Periapical Pathology," by L. H. Grace; "Prosthesis," by H. G. Maize; "Technic of Preparing Local Anaesthetic Solutions," by Herman Prinz; Subject to be announced, by Oscar Wayne; "Cystic Formation from an X-Ray Standpoint," (lantern demonstration), by Thomas B. Wade.

Special clinics for limited classes, as follows: "Porcelain Jacket Crown," by J. C. Curry. (One hour and a half duration; given twice.) "Orthodontia for the General Practitioner," by S. P. Cameron. (One hour duration; given three times.)

There will be a banquet on Saturday.

The services of those conducting courses, of the clinicians, and all others concerned in

celebrating this event, are given freely and without remuneration. The income from the fees charged will be used to defray current expenses, such as printing, cost of materials and rental of premises. Any surplus remaining will be forwarded to the Relief Fund of the National Dental Association.

JOHN BURKHARDT, JR., *Secretary*
842 N. Twenty-fourth St., Philadelphia, Pa.

IDENTIFICATION WANTED OF MURDER VICTIM

On April 28, 1921, the charred body of an unknown man that had been shot with a gun loaded with buck shot and then saturated with oil and set on fire was found near San Diego, California.

The body is described as that of a man between the ages of twenty-five and forty years; 5.2 to 5.5 feet in height; 135 to 140 lbs. in weight.

The victim had the following dental work, which was of such a nature that it should be immediately recognized by the dentist who did the work: Bridge from upper left cuspid to upper right lateral, swung behind upper right central; upper right cuspid crowned with gold; upper left lateral and central porcelain, long pin facings.

Any information or lead which may seem worthy of investigation in connection with this case would be gratefully received. Please communicate any information to

SCHUYLER C. KELLY, Coroner,
San Diego County, California.

DENTAL CORPS ORDERS FROM WAR DEPARTMENT

Navy

Lieutenant Henry Muenzer, navy yard, New York; to Pueblo.

Lieutenant I. N. Wood, R. S., Philadelphia; to home.

Lieutenant A. E. D'Armons, naval station, Key West; to home.

Lieutenant Commander F. L. Morey, Arkansas; to Arizona.

Lieutenant B. F. Sweeney, Arizona; to Arkansas.

Lieutenant J. C. Lough, to home and wait orders.

Lieutenant R. W. Quesinberry, Wyoming; to Nevada.

Lieutenant Commander T. L. Sampsell, Nevada; to Wyoming.—*Army and Navy Register,* July 23, 1921.

Lieutenant (J. G.) R. H. Fladeland, R. S., Philadelphia; to marine expeditionary force, Haiti.—*Army and Navy Register,* July 30, 1921.

Lieutenant J. C. Lough, to naval air station, San Diego, Cal.

Lieutenant Commander E. H. Tennent, naval station, Guantanamo Bay, Cuba, to home, wait orders.

Lieutenant A. T. Fellows, R. S., Philadelphia; to naval station, Guantanamo Bay.—*Army and Navy Register,* August 6, 1921.

Lieutenant E. N. Cochran, naval hospital, Fort Lyon; to Melville.

Lieutenant J. J. Haas, Melville; to Great Northern.

Lieutenant T. W. Spear, naval hospital, Great Lakes, to connection with fitting out Wright and on board when commissioned.

R. D. Reid, of Nebraska, assistant dental surgeon, lieutenant (J. G.), from July 7, 1921.—*Army and Navy Register,* August 13, 1921.

Lieutenant L. T. Conditt, naval hospital, New Orleans; to duty at marine barracks, Parris Island.—*Army and Navy Register,* August 20, 1921.

The following promotion in the Navy is announced: John E. Morgan to be past assistant dental surgeon.—*Army and Navy Register,* August 27, 1921.

Army

Captain William H. Hoblitzell from duty at Presidio of San Francisco to Denver, Colo., Fitzsimons General Hospital for duty.

Captain Julius L. Bischof from duty at Fitzsimons General Hospital, Denver, Colo., to Presidio of San Francisco and report to commanding general 9th corps area for assignment to duty and station.—*Army and Navy Register,* July 23, 1921.

Captain Jay R. Haskin from duties at Camp Meade, Md., to Camp Holabird, Md., for duty.

Captain William H. Siefert from duties in Philippine Department, effective upon completion of present tour of foreign service and report to commanding general 9th corps area for assignment to duty and station.

Capt Marhl H. Welch from duties at Fort Sam Houston, Tex., to San Francisco and about October 7 to Philippine Department for duty.

Captains Emory C. Bardwell, Joseph E. Eden, Herbert E. Guthrie, Ralph O. Leonard, William E. Sankey. First Lieutenants John C. Burr, Charles E. Callery, Egbert W. Cowan, Robert C. Craven, Roy L. Denson, Leon A. Jones, Glenn D. Lacey, Rufus W. Leigh, Clarence C. Olson, John S. Ross, Melville A. Sanderson, Arne Sorum, Harold S. Whitney, Henry A. Winslow, Frank A. Crane to Carlisle Barracks, Pa., and report August

1 at medical field service school for course of instruction.

The following promotions in the Regular Army, with rank as indicated, are announced: First Lieutenant Arthur C. Foard, promoted to captain, June 27. First Lieutenant Elmer H. Nicklies, promoted to captain, July 13.—*Army and Navy Register,* July 30, 1921.

Captain George R. Kennebeck, now on temporary duty at Carlisle Barracks, Pa., relieved from further duty at Camp Dix, N. J., and will report to the commandant, medical field service school, Carlisle Barracks, for duty.

The following promotions in the Regular Army are announced: To be captains: Willis B. Parsons, Joseph H. Jones, Glenn D. Lacey and George M. Babbitt.—*Army and Navy Register,* August 13, 1921.

Lieutenant Colonel Frank P. Stone from duties as assistant to surgeon, 7th corps area, Fort Crook, Neb., to Carlisle Barracks, Pa., medical field service school for duty.

Resignation by Captain Avery S. Hills, to take effect upon arrival in United States, is accepted.

The following promotions in the Regular Army are announced: To be captains: John S. Ross, Harold S. Whitney and Hugh J. Ryan.—*Army and Navy Register,* August 20, 1921.

Major Frederick R. Wunderlich from duties at Camp Meade, Md., and detailed as professor of military science and tactics at University of Minnesota, Dental College.

First Lieutenant Roy L. Denson honorably discharged with one year's pay.

The following promotions in the Regular Army are announced: To be captains: Walter D. Love and Clarence W. Johnson.—*Army and Navy Register,* August 27, 1921.

PATENTS OF INTEREST TO DENTISTS

1361661, Orthodontia appliance, Charles L. Alexander, Charlotte, N. C.

1361703, Dentist's record holder, Robert J. Fennell, New York, N. Y.

1361376, Dental meter, Joseph Fisher, Winnipeg, Canada.

1361578, Surgical engine, George D. Heck, Prince Bay, N. Y.

1361188, Adjustable sprue, Carl H. Schmidt, Port Washington, Wis

1361199, Closure for collapsible capsules, John M. Tallantyre, New Brighton, England.

1361200, Anesthetizing apparatus, C. K. Teter, Cleveland, Ohio.

56728, Design, Pedestal for dental apparatus, Oscar H. Pieper and A. F. Pieper, Rochester, N. Y.

1361842, Toothbrush holder, Leo E. Evslin, New York, N. Y.

1361857, Automatic toothpick and match picker, Frank Hille, Long Island City, N. Y.

1362536, Broach operating mechanism, Ralph R. Lapointe, Hudson, Mass.

1362339, Orthodontia appliance, Gustavus A. Millard, Los Angeles, Cal.

1362269, Folding toothbrush, Paul G. Schwarz, Indianapolis, Ind.

1362201, Ether administering apparatus, Charles K. Teter, Cleveland, Ohio.

1362602, Dental articulator, Lucien C. Coble, Greensboro, N. C.

1362680, Dental-engine handpiece, Robert C. Craig, Abingdon, Va.

1362937, Fountain-brush, Walter Grace, Auckland, New Zealand.

1362873, Apparatus for use in preparing anesthetics, Herbert R. Kersten, Boston, Mass.

1363128, Injection syringe, Nobuchika Nitaoka, Tottori-Ken, Japan.

1362809, Preparation of molds for dental and jewelry casting and the like, John A. McManus, Lynn, Mass.

1362821, Centrifugal casting machine, Finis E. Roach, Chicago, Ill.

1363169, Artificial tooth, Frederick W Shapeley, Canton, Ohio.

1363534, Orthodontic apparatus, Alfred P. Rogers, Newton, Mass.

1364480, Apparatus for manufacturing pinless teeth, Myer Charen, Philadelphia, Pa.

1364188, Toothbrush, Johannes Draenert, Ellenburg, Germany.

1364367, Dental floss holder, James B. Goodrich, Los Angeles, Cal.

1364557, Sterilizing holder for toothbrushes, Roy F. Hurley, Galesville, Wis.

1363151, Mouth mirror, Raleigh H. Staley, Springfield, Ill.

56858, Design, Toothbrush, James S. Cahill, Richmond, Va.

1364873, Throat-lamp and tongue depressor, John E. Fitzgerald, New York, N. Y.

1365962, Artificial tooth, Nathan Bloom, Philadelphia, Pa.

1366058, Dental bridge-work, Herman E. S. Chayes, New York, N. Y.

1365678, Rotary tooth cleaner, Horace E. Frame, Mount Vernon, N. Y.

1365684, Tongue-shield, Gaitley Guise, Riley, Ind.

1366092, Tooth-cleaning device, Emanuel Loewenherz, Chicago, Ill.

1366231, Sterilizable cautery, William A. Winter, East Orange, and L. Day, Mount Lakes, N. J.

1366628, Orthodontic appliance, Edward H. Angle, Pasadena, Cal.

1366877, Guide and gage for dental drills, Joseph E. Craig, Gary, Ind.

1366644, Suction device for artificial dentures and manufacturing same, Arthur Fisher, London, England.

1367130, Dental casting-ring, Walter H. Farnham, Buckport, Me.

1367385, Toothbrush, Thomas Harrison, Weston, Canada.

57044, Design, dental die device, John H. Hollison and C. H. Miller, Chicago, Ill.

1368094, Protecting device against X-rays and similar radiations, Pierre A. M. J. Angebaud, Nates, France.

1367851, Orthodontic appliance, Edward H. Angle, Pasadena, Cal.

1367601, Cassette for X-ray films, Millard B. Hodgson, Rochester, N. Y.

1367885, Dental appliance, Joseph K. Means, Decatur, Ill.

1368195, Dental instrument, Waller E. Pearl, Sedalia, Mo.

1367627, Dental impression flask or tray, Finis E. Roach, Chicago, Ill.

1368555, Dental-floss holder, George C. Henerlau, Newark, N. J.

1368799, Dental-floss holder, Leo J. Hogarty, Brooklyn, N. Y.

1368408, Articulator, John W. Needles, Pueblo, Colo.

1368589, Collapsible tube, Charles Weber, Newark, N. J.

1368078, Artificial denture, Ralph V. Blake, Yonkers, N. Y.

1369171, Dental impression tray, Arthur T. Graham, San Francisco, Cal.

1369664, Toothbrush, Riichiro Izawa, Kyoto, Japan.

1369665, Orthodontic appliance, Joseph E. Johnson, Louisville, Ky.

1369112, Dental nerve broach, Truman W. Jones, Coatesville, Pa.

1369182, Casting flask for dentists, Thomas E. Moore, Toledo, Ohio.

1369460, Toothbrush holder, Benjamin R. Morrison, Wilmington, N. C.

1369718, Instrument for handling artificial teeth, Thomas Steele, Columbus, Ohio.

1369582, Dental tool, Louis P. Wagner, Milwaukee, Wis.

1369509, Artificial denture, Isaac Weintraub, New Haven, Conn.

1369209, Dental amalgam machine, Alfred C. Wright, Philadelphia, Pa.

1369768, Dental impression tray, Carl E. Anderson, Prince Bay, N. Y.

1369966, Toothbrush, Arthur Cosens and T. R. Peden, Vancouver, Canada.

1370192, Making artificial teeth, Walter W. Crate, Camden, N. J.

1370191, Mold for making artificial teeth, Walter W. Crate, Camden, N. J.

1369935, Hot-air syringe, Oscar H. and A. F. Pieper, Rochester, N. Y.

1370793, Sanitary toothbrush holder, John A. Duggan, Battle Creek, Mich.

1371029, Dental applicator, Albert G. Jennings, Brooklyn, N. Y.

1371173, Toothpick dispensing device, John E. Kenkel, Great Falls, Mont.

1370720, Removable dental bridge, George C. Witt, Indianapolis, Ind.

1371537, Linguar bar, Hugo Aderer, East Orange, N. J.

1371245, Dental press, Fernando O. Jaques, Jr., Providence, R. I.

1371790, Mouth-cleaning device, John L. Kelly, New York, N. Y.

1371428, Blowpipe, Ernest C. Meeker and W. B. Woodside, Hilo, Hawaii.

1371507, X-ray stand and table, William Meyer, Chicago, Ill.

57327, Design, Toothbrush, Wesley B. Gibson, East Orange, N. J.

1372012, Articulator, Charles H. Downing, Evans, Colo.

1372080, Tooth-crown, bridge, and the like, Isaac Masel, Philadelphia, Pa.

1372209, Molding flask for dentists' use, Giuseppe E. Terranova, New Haven, Conn.

1372110, X-ray apparatus, Sinclair Tousey, Westhampton Beach, N. Y.

1373116, Dental water heater, Elmer W. Bunce, Minneapolis, Minn.

1373170, Press for metallic denture backings, Robert M. Craig, Wilkinsburg, Pa.

1372772, Manufacturing porcelain jacket-crowns, Chotoku Nishi, San Francisco, Cal.

1372735, Blowpipe, George H. Zouck, Orange, N. J.

57434, Design, amalgam carrier and plugger, Gustav Holtz, Gouldsboro, Pa.

1373847, Stereoscope for X-ray plates, Harry F. Waite, New York, N. Y.

1374183, Dental impression tray, Joseph S. Bridges, Chicago, Ill.

1374845, Collapsible tube holder, John H. Gibbs, West Orange, N. J.

1374235, X-ray photographing appliance, Gordon E. Richards, Toronto, Canada.

1374792, Dental appliance, Edgar E. D. Woisard, Pittston, Pa.

1375479, Package for dental solder and the like, George L. Van Allen, Prince Bay, N. Y.

1375954, Dentifrice dispensing device, Charles Doyle, San Francisco, Cal.

1376373, Extruding collapsible tubes, William C. Huntoon, Providence, R. I.

1376374, Drawing collapsible tubes, William C. Huntoon, Providence, R. I.

1376375, Collapsible tube, William Huntoon, Providence, R. I.

1376376, Extruding collapsible tubes, William C. Huntoon, Providence, R. I.

1376356, Unitary dental appliance, O. H. and A. F. Pieper, Rochester, N. Y.

1376163, Dental impression tray, Leslie V. Robinson, New York, N. Y.

1375865, Toothbrush receptacle and holder, Anton G. Sulak, Seattle, Wash.

57584, Design, Toothbrush, Arthur A. Campbell, Santa Monica, Cal.

1376514, Conversion of carbon monoxide into carbon dioxide, John C. Clancy, Niagara Falls, N. Y.

1376616, Toothpick machine, Edward Greenwood, Phillips, Me.

1377075, Dental articulator, Joseph Homer, Boston, Mass.

1376644, Artificial tooth, Frank H. Russell, Elko, Nev.

1376645, Artificial tooth, Frank H. Russell, Elko, Nev.

1376991, Blowpipe, George H. Zouck, Orange, N. J., and G. L. Walker, New York, N. Y.

57780, Design, spatula, John H. Lickert, Evanston, Ill.

1377474, Making backing-plate for artificial teeth, Ami H. Gunther, Chillicothe, Ohio.

1377680, Amalgam-mixer for dentists, Loyd R. Haight, Spokane, Wash.

1377358, All-porcelain tooth, Howard S. Lowry, Kansas City, Mo.

1377725, Sterilizing surgical instruments and other articles, James B. Pentz, New York, N. Y.

1377726, Sterilizer, James B. Pentz, New York, N. Y.

1377432, Dental engine bracket, O. H. and A. F. Pieper, Rochester, N. Y.

1377433, Dental cuspidor, O. H. and A. F. Pieper, Rochester, N. Y.

1378527, Gage for selecting artificial teeth, William C. Dalbey, Du Quoin, Ill.

1378530, Toothbrush, Leo E. Evslin, New York, N. Y.

1378781, Toothbrush, Ernest Glass, Reading, Pa.

1378044, Collapsible toothbrush, Converse W. Lloyd, New York, N. Y.

1378709, Holder for dental X-ray films, James M. Martin, Dallas, Tex.

1378064, Forming molds for dentists' use, Giuseppe E. Terranova, New Haven, Conn.

1378433, Dental instrument, Frank Vogelzang, Rock Valley, Iowa.

1378297, Dental impression tray, Frank W. Wallace, Chattanooga, Tenn.

1378745, Gage for selecting artificial teeth, John A. Wavrin, St. Louis, Mo.

1378157, Toothbrush, William L. Webster, New York, N. Y.

1378306, Dental appliance, Jacob L. Young, New Rochelle, N. Y.

1379445, Dental tool, Feliciano Gonzalez, New York, N. Y.

1379360, Blowpipe apparatus, Raymond B. Pickering, Alameda, Cal.

1379046, Dentifrice, William S. Rogers, New York, N. Y.

1379489, Filling teeth and dental matrix for use therein, Daniel E. Taylor, Willimantic, Conn.

1379063, Dental shell, George L. Van Allen, Prince Bay, N. Y.

1380040, Dental attachment, Herman E. S. Chayes, New York, N. Y.

1379744, Preparation for the teeth, William Congreve, Cheltenham, England.

1379689, Specimen set-up for artificial teeth, Milus M. House, Indianapolis, Ind.

1379708, Blowpipe, Clayton Laing, Chicago, Ill.

1380246, Toothbrush container, Edward M. Peters, Medford, and P. Vilardo, Somerville, Mass.

1379880, Dental handpiece, Charles C. Seaborn, Portland, Ore.

Copies of above patents may be obtained for twenty-five cents each, by addressing John A. Saal, Solicitor of Patents, Fendall Building, Washington, **D. C.**